C8650-1A

DATAMATION

85

INTERNATIONAL EDITION NOVEMBER 1 $3 © TECHNICAL PUBLISHING

JAPAN TRADE: THE HURDLES GET LOWER

ANNUAL MINI-MICRO SURVEY

DATA INTEGRATION TECHNOLOGY

ON THIN ICE: MICROS AND DATA INTEGRITY

DATAMATION

NOVEMBER 1, 1985/$3 U.S.A.
VOLUME 31 NUMBER 21
This issue, 191,933 copies

FEATURES

20

IN FOCUS

As "IBM's PC Paces the Pack," minicomputer systems grow pricier. That and other findings are reported by John W. Verity in our 1985-86 DATAMATION/Cowen & Co. mini/micro computer survey.

80

ON THIN ICE: MICROS AND DATA INTEGRITY

Irene S. Nesbit

As new technology provides users with greater ability to share data, we must invent new procedures and methods to ensure the integrity of those data.

89

PC SECURITY: SO WHAT'S NEW?

Joel S. Zimmerman

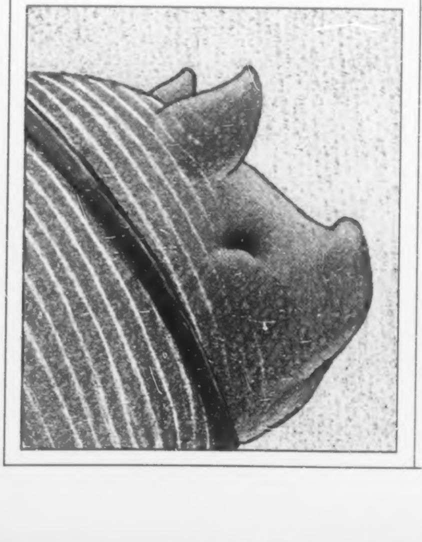
Even as they implement safeguards for the plethora of micros, data security officers seem doomed to suffer many more headaches.

98

A BANKING SOFTWARE STORY

Tom Lawton

Some banks are demanding complex software products to integrate all their data processing. Are vendors up to satisfying those desires?



106

THE TECHNOLOGY OF DATA INTEGRATION

Daniel S. Appleton

No one, not even IBM, has succeeded in building a software system that presents the illusion of a single, integrated, consistent, nondistributed database—even though most information resource management professionals would give their left incisor for one.

121

PROJECT EVALUATION MADE SIMPLE

Donald Spadaro

Failure to accurately evaluate systems projects can result in increased project backlog, dissatisfied users, loss of hair, or unexpected early retirement. Here's how to cut down backlog, pacify users, and keep your hair and your job.

129

HEADLESS AND OPTIONAL ARROWS

Frank Sweet

Frank forges fearlessly forward: parts six and seven of a 14-part series.

NEWS IN PERSPECTIVE

36 **TRADE**
The kimono is open.

43 **MANAGEMENT**
Hard times at CDC.

50 **SOFTWARE**
Putting the "S" into IBM.

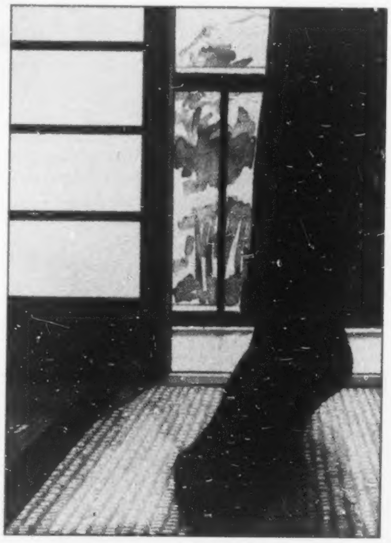
60 **DISK DRIVES**
Floppy fortunes flounder.

66 **COMPUTERS**
Cpu nabs suspect.

73 **BENCHMARKS**

DEPARTMENTS

9 **LOOK AHEAD**
15 **LETTERS**
17 **EDITORIAL**



135 **PEOPLE**
139 **HARDWARE**
147 **SOFTWARE**
153 **SOURCE DATA**
161 **READERS' FORUM**
164 **MARKETPLACE**
164 **ADVERTISERS' INDEX**

INTERNATIONAL 76-1

-4 **FIGURING OUT THE PC PUZZLE**
-13 **EUROPE'S PC PATH**
-19 **SEEKING NETWORK SOLUTIONS**
-27 **THE CONTINENTAL CHALLENGE**

COVER ILLUSTRATION BY ANDREA BARUFFI

IN FOCUS

IBM'S PC PACES THE PACK

Our annual mini/micro survey forecasts familiar faces in the winner's circle.

by John W. Verity

Minicomputer shipments during the year ending June 1986 will be up just 13.3% over the previous year in terms of dollar volume, according to the 1985-86 DATAMATION/Cowen & Co. mini/micro computer survey. This represents a substantial decline from the 25% growth forecast in last year's survey and is attributable largely to the ongoing strength of IBM's PC family.

Meanwhile, there will be a continuing deceleration of growth in personal computer shipments—only 24% growth in dollar volume compared with the 63% forecast last year—even as micros continue to encroach on business that once went to minis alone. The survey, made in July and August, found about a quarter of all mini sites (24%) and two fifths of pc sites (39%) expecting to spend more for those types of equipment in the year ending June 1987 than they will have spent in the previous 12 months.

Special attention was paid this year to, among other topics, AT&T and its Unix operating system, the needs and plans of those using Digital Equipment VAX computers, the IBM PC and related software markets, and the effect of pcs on minicomputer markets.

This year's survey tallied responses from 6,412 mini/micro sites where 27,557 minicomputers were operated and some 90,000 personal computers were purchased in the past year and a half. Most of these sites (93%) are end users, as opposed to systems houses and oems, which ultimately resell the gear they described for the survey.

As in previous surveys, results show that the rate at which minicomputer makers are signing up new users is falling as the market matures. The compound annual growth rate of the user base is 9% for the past five years, but 15% for the past eight years. The minicomputer system types showing the strongest growth in new users are workstations and intelligent terminals, which outperformed small business systems, traditional minis, and data entry and office systems.

One traditional application area for minis, scientific/engineering calculation, will slip almost a full percentage point in its share of the total shipments indicated by respondents for 1985-86. The strongest application areas appear to be standalone business data processing, on the strength of IBM's S/36.

Market activity seems dampened. Although responses varied according to the mode of buying and the primary equipment vendor involved, users indicated less anticipation than last year that their pc and mini suppliers would unveil major systems in coming months. Last year's survey found 26% of the minicomputer sites and 38% of the pc sites expecting major announcements, but this year the comparable numbers were 23% and 32%, respectively. The fall in expectations held among end-user and oem/systems house sites alike, although 37% of the latter (down from 45% last year) still said they expected to see major product introductions soon. Among the vendors seen as most likely to spring new products are Data General, Hewlett-Packard, and Apollo Computer of Chelmsford, Mass. The products mentioned as likely to surface include DEC's MicroVAX III and machines code-named Scorpio, Nautilus, Neptune, and Nebulus; HP's Spectrum; Data General's MicroEagle and MV/12000; and IBM's long-expected PC2.

Where important new products have been introduced or first shipped since the last survey, shifts have occurred in buying patterns. For instance, in terms of dollars, DEC VAX sites indicated a growing appetite for the model 8600 system (37.4% of the total spending for VAX equipment during the next 18 months, compared with 15.3% for the last 18 months), while the original VAX-11/780 and its companion model 785's dollar share tapered from a total of 56.3% in the previous 18 months to 31.6%. The MicroVAX II has gone from a mere 0.5% of VAX spending to 15%. Indeed, in both technical and commercial arenas, the MicroVAX II was mentioned by 45% of VAX sites as the primary VAX machine for new applications: the prospects for that VLSI-based machine to grab a large share of the total VAX pie seem substantial. Nevertheless, the venerable PDP-11 is still holding its own at 16% of the value of all DEC shipments to responding sites.

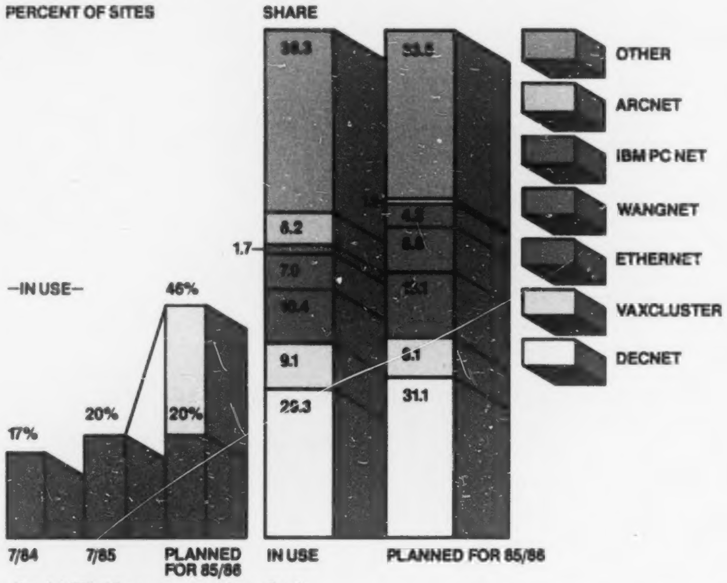
Among the vendors seen as most likely to spring new products are Apollo, Data General, and HP.

In most cases, average minicomputer system prices have risen substantially in the past five years, more than doubling for some vendors. For instance, Data General machines purchased in 1980-81 averaged $35,000, but those purchased in 1984-85 went for an average of $101,000. Machines from Tandem Com-

FIG. 1

LOCAL AREA NETWORKS

Query: Do you have in use now, or do you plan to use initially in 1985/86, a local area network (LAN)?



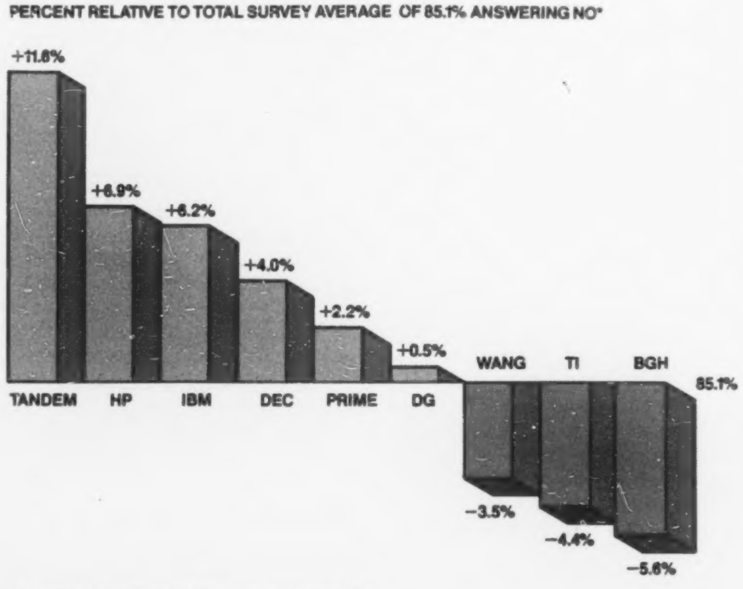
*Implicit 74%, 1.5-year compound growth rate

**includes 3-COM 3.0%, Novell 2.6%, Sytek 0.9%, AT&T Starlan 1.3%, AT&T Other 2.5%, Primenet 1.3%, etc.

FIG. 2

CUSTOMER LOYALTY

Query: Do you expect to change to another manufacturer as your primary source of minicomputers in 1985/86?



*As opposed to answering Yes or Seriously Considering

puters of Cupertino, Calif., and Prime Computer of Nadick, Mass., however, now sell for a lower price than five years ago: for example, Tandem's average system price was $268,000 then but is only $202,000 now. The increasing popularity of DEC's MicroVAX II will probably trigger a fall from $143,000 to $98,000 in the average price of DEC systems purchased during 1984-85 and 1985-86, respectively.

For Data General, the most important 32-bit machines will be the highest-performance MV models, the 10000 and upcoming 12000, accounting for a total of 55.7% of the total planned purchases by respondents. The original model 8000's share (including the 8000-2) of 32-bit dollars spent with that vendor will fall from 36% in 1984-85 to only 10.6% in the next 18 months. Similarly, Prime stands to see 53.9% of its revenues from survey respondents come from its model 9955.

Average minicomputer system prices have risen substantially in the past five years, more than doubling for some vendors.

AT&T, once a major source of business for minicomputer vendors, has shifted to its own systems in a big way. In the upcoming 18 months, the survey shows, AT&T sites will use AT&T minis 93.1% of the time, while DEC's share continues to fall, hitting near bottom at a mere 3.4%. Nevertheless, AT&T has had only limited success in penetrating minicomputer markets beyond its own boundaries. About 76.3% of the purchases of AT&T 3B minis planned by respondents will go to internal AT&T sites. Of the 3Bs used by respondents, 67.5% are scheduled for communications work (including systems run by the Bell operating companies), 9.2% for education, and 11.3% for financial services systems.

The Unix operating system, on which AT&T has been relying as a wedge into the IBM-dominated market, still ranks low on users' lists of criteria for selecting computer systems. Both technical and commercial sites ranked "strong Unix offering" as only the 12th most important criterion, while compatibility with installed systems and hardware reliability were most important to those two types of users, respectively.

As a primary operating system, Unix has made only modest inroads: 7.8% of the respondents indicated that Unix is now their main operating system and another 4.4% said it would become their main system in the next 18 months. But that future total of 12.2% is down from the comparable figure of 13.8% measured last year. A similar drop, from 18.2% last year to 15.8%, was seen in the use of Unix as a secondary system.

Evidently, newer suppliers such as AT&T, Sun Microsystems of Mountain View, Calif., and Altos Computer Systems of San Jose have come to depend on Unix and its derivatives most heavily. Only 14.3% of DEC sites, for instance, said Unix would be their primary operating system, but users of Sun, Altos, and AT&T each showed greater than 92% planned usage. Of current users of Unix, DEC sites are most heavily represented, with 35%. Next are IBM at 10% and HP at 9%. And, not surprisingly, Unix is more widely used in technical than in commercial applications, particularly in software development. AT&T's System V is the most popular Unix variant, followed by the Berkeley 4.2 version and Microsoft's Xenix.

Slight increases were found in the use of such advanced programming languages as Ada, Lisp, and Prolog. Respectively, 7.4%, 8.9% and 4.3% of survey respondents said they would use those languages by the end of next year. Lisp was found most heavily used in educational sites followed by software development sites.

AT&T, once a major source of business for minicomputer vendors, has shifted to its own systems in a big way.

Interest in fault tolerant systems held at traditional survey levels, but doubts about the real size of this market raised by past years' surveys were confirmed. Asked if they would like their current vendor to supply a fault tolerant version of its minicomputer system, 3.1% of respondents said they already had such a machine installed, 15% said they would like such a system and would pay extra for it, and 36% said yes, but they would not pay extra for it. When asked if they would still be interested in this capability if it were not compatible with their current systems (say, an IBM 370 or VAX), 40.5% said no and only 10.5% said yes. As noted last year, this response suggests a much narrower market potential for new, proprietary fault tolerant systems than might have been expected.

FIG. 3

TOP DOZEN MINICOMPUTER SYSTEMS 1985/86

A. BASED ON NUMBER OF RESPONDENTS ACQUIRING SYSTEMS (7/85–12/86)

MANUFACTURER	SYSTEM	HOW MANY SITES ACQUIRING	AVERAGE UNITS PER SITE
IBM	System/36	224	7.9
DEC	MicroVAX-II	196	2.9
DEC	VAX, Unspecified	83	2.0
DEC	VAX-11/750	83	1.3
DEC	VAX 8600	75	1.4
DEC	VAX-11/785	67	1.4
DEC	VAX-11/780	64	1.3
HP	3000, Unspecified	52	2.8
IBM	System/38	47	1.2
DEC	PDP-11/84	42	1.8
DG	MV/4000	36	3.2
IBM	Series/1	34	9.8

B. BASED ON NUMBER OF UNITS BEING ACQUIRED (7/85–12/86)

MANUFACTURER	SYSTEM	HOW MANY UNITS BEING ACQUIRED	EST. VALUE ($ MILLIONS)
IBM	System/36	1,774	$103.4
DEC	PDP-11/73	621	9.3
DEC	MicroVAX-II	567	21.2
Burroughs	B20/B25	345	2.1
IBM	Series/1	332	12.7
Altos	986	251	2.5
DEC	VAX, Unspecified	164	35.6
HP	3000, Unspecified	144	31.2
Data General	Eclipse, MV/4000	144	12.2
DEC	VAX 8600	104	53.1
DEC	VAX-11/750	104	13.8
Data General	Eclipse, MV Unspecified	104	5.7

- The respondents also plan to acquire:
  - 95 DEC VAX-11/785s for $26.2 million and 81 VAX-11/780s for $22.9 million
  - 21 AT&T 3B20s for $6.3 million, 224 3B2s for $7.5 million
  - 95 DG MV/10000s for $19.6 million
  - 56 IBM System/38s for $14.8 million
  - 25 Prime 9955s for $8.6 million
- In total, 2,094 respondents reported plans to acquire 9,867 systems valued at over $693 million between 7/85 and 7/86.

In the "integrated" office systems arena, it was found that a handful of suppliers has captured the majority of installations, both planned and existing. IBM was found to have a 23.7% share, about even with DEC's 22.9% share; they were followed by Wang's 11.8%, Data General's 10.6%, and HP's 5.1%. Altogether, only 18% of survey sites had such systems installed or planned for future installation; usage is heaviest with large organizations (e.g., 31% of users showing annual revenues over $500 million). Except where IBM is the principal supplier—where mainframes still dominate and networked PCs are on the rise—integrated office systems tend to be based on shared minis. Forty-nine percent of the office system users said IBM communications compatibility (i.e., under System Network Architecture) was "very desirable."

Previous surveys in this series have shown the microcomputer in general, and IBM's PC in particular, making strong inroads in markets that were once the province of minicomputers. The microcomputer continues to extend its reach, although not as strongly as in the past few years. Last year, for instance, the year-to-year growth in new pc users within the survey population was measured at 65%, but this year's growth is only 22%. This suggests a maturation of the market in which most sites already have at least one pc installed. There may be only single-digit growth by next year. The slowdown in growth seems to be taking place among sites using all types of pcs—IBM, Apple, and all the rest.

The few new pc users are, not surprisingly, choosing IBM as their main supplier. That company has gained 63.3% of new pc users in the past year, compared with Apple's mere 4.6%.

The application of pcs is strongest among banking and educational sites. Asked how many hours on average they used their pcs, respondents matched last year's number of 4.9 hours. The most rapid rise in pc applications has been in remote terminal emulation and graphics processing, but spreadsheet and word processing work continue to dominate.

In terms of sites, the "independent store" remains the predominant channel through which to acquire a pc (53.8%), particularly for machines from Houston-based Compaq Computer Corp. (88% of sites). About 63% of IBM sites buy from a store and another 25% buy direct from IBM. (For DEC, HP, and Wang, over 60% buy direct from the manufacturer.) When measured in terms of unit volume, however, "direct from manufacturer" is the leading channel of acquisition (51.8%). A shift was noted in the source of IBM PCs, from direct to the independent store, suggesting that Apple is losing retail shelf space. On the other hand, educational sites, where Apple is particularly strong, are heavily skewed toward acquisition direct from the vendor.

Even more than hardware, pc software is bought at independent stores. While only 22.9% of such software comes directly from the manufacturer, 58.2% comes from independent stores.

Selection of pcs is based heavily on compatibility with prior systems and the availability of software. While a quarter of the responding sites mentioned the viability of their pc vendor as a major selection criterion, the other two factors were each mentioned by 60% of the sites. For the first time, the IBM PC ranked ahead of Apple for software availability, but the industry leader's machine continued to lag the Silicon Valley vendor when it comes to ease of use and quality of displays.

Software continues to capture a rising share of the average user's pc spending. Software purchases accounted for 19.2% of the spending in the 12 months preceding the survey and stand to make up 20.4% of the coming year's spending. Helping to fuel that trend is the continuing perception by users that the quality of pc software exceeds that of minicomputer packages.

As a primary operating system, Unix has made only modest inroads.

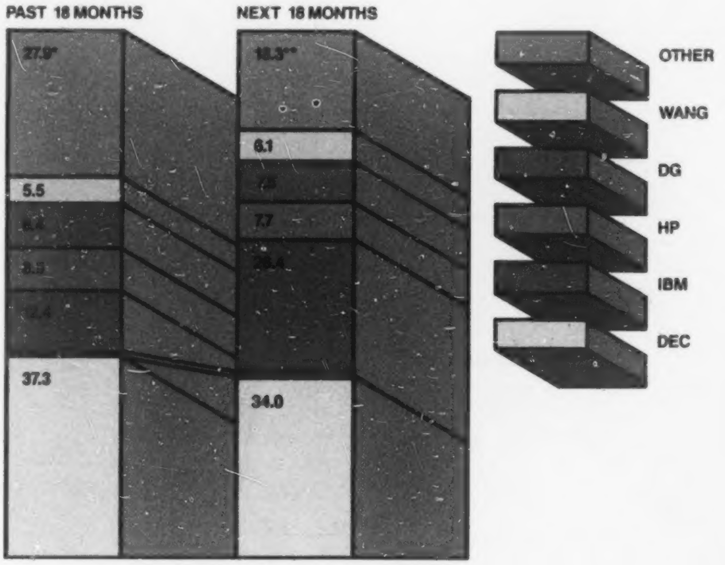
Lotus 1-2-3 and Wordstar continue to rank as the leading software packages for pcs among survey respondents. The former was mentioned by 68% of respondents while the latter was mentioned by 41%. Runners-up included various database packages and Multiplan. Lotus's Symphony showed up at only 20.8% of the sites, while IBM's DisplayWrite came in just under MultiMate's score of 7.3%. Nevertheless, IBM stands to push its way into the top five software packages to be used in the upcoming 18 months

FIG. 4

MINICOMPUTER PURCHASES

TOTAL SYSTEMS

PERCENT OF INDICATED SPENDING (IN DOLLARS)

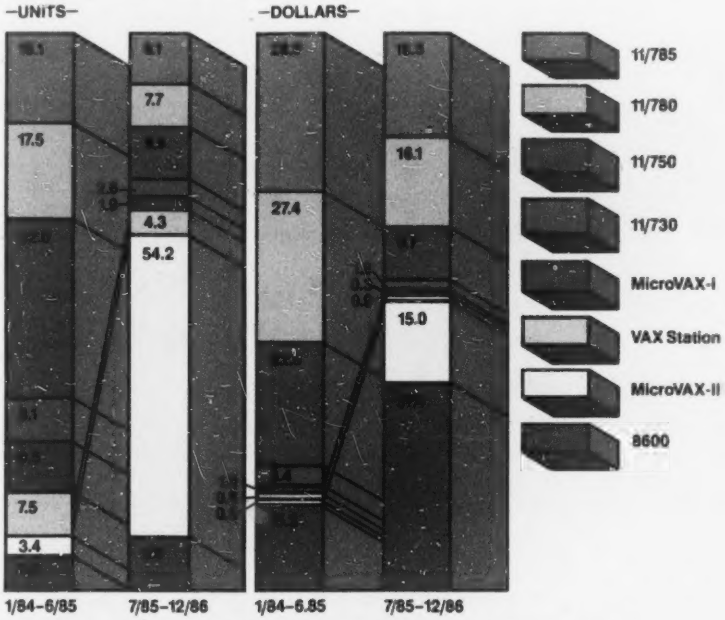


*Past 18 months includes: Prime 5.9%, AT&T 2.4%, SEL 1.5%, Tandem 1.5%
**Next 18 months includes: Prime 2.6%, AT&T 2.3%, SEL 1.6%, Tandem 1.6%

FIG. 5

VAX PRODUCT MIX

PERCENT OF RESPONDENT VAX* PURCHASES



*Excludes unspecified VAX models; VAX-II/725 and VAX-II/782 quantities nominal in these data with DisplayWrite and TopView. By the same token, Wordstar's star seems to be falling. While TopView, IBM's windowing package, is currently in use at only 2.6% of the survey sites, users indicated that figure would reach 6.6% by the end of next year. Lotus's Jazz is now at 2.1% of the sites but the survey predicts it may get to 5.4% in the same time period.

Compatibility has been an issue in the pc market ever since IBM unveiled its market-winning PC in 1981, and this year's survey shows that systems-level compatibility is more important (64% of sites) than applications-level compatibility. This augurs well for the equipment manufacturer but less so for the independent software supplier. Of those sites that had standardized on one or two pc suppliers, 69% chose to do so along systems lines (MS/DOS, for instance), but only 26% at the software package level (e.g., Lotus 1-2-3).

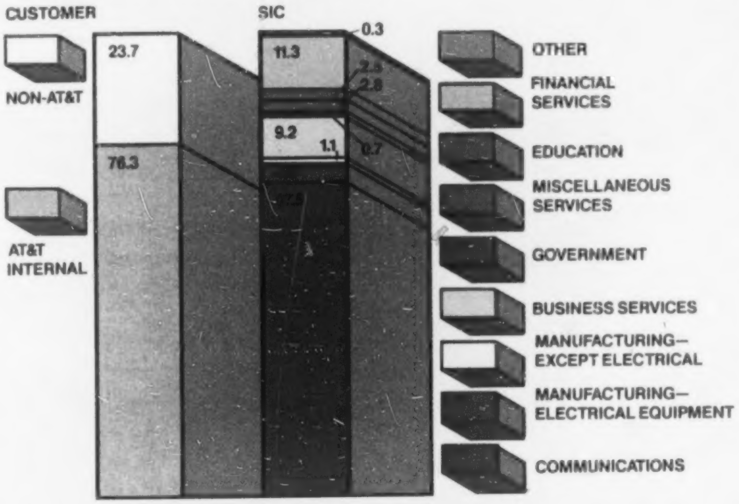
For the first time, the IBM PC ranked ahead of Apple for software availability.

Lotus is the major beneficiary of the ongoing standardization of pc software packages. Two fifths of the respondents have chosen 1-2-3 as a standard

FIG. 6

AT&T 3Bs SLOW TO TAKE OFF

RESPONDENT PLANNED 3B UNIT PURCHASES



- Manufacturing-Electrical Equipment SIC includes old Western Electric
- Communications SIC includes the old Bell Operating Companies
- Business Services includes computer and data processing service (i.e., much of systems house population)
- Manufacturing-Except Electrical includes office machine suppliers (e.g., hardware oems)
- These data do not reflect the recent very large 3B contract awards from the government sector (e.g., NSA)

TERMINALS FROM TRANSNET

PURCHASE PLAN - 12 & 24 MONTH FULL OWNERSHIP - 36 MONTH LEASE PLAN

DESCRIPTION		PURCHASE PRICE	PER MONTH 12 MOS	24 MOS	36 MOS
DEC					
LA50	Personal Printer	$599	$ 58	$ 32	$ 22
LA210	Letter Printer	1,299	125	70	47
LA120	DECwriter III KSR	2,195	211	117	79
VT220	Video Terminal	849	83	46	31
VT240	Graphics Terminal	1,850	178	99	67
VT241	Color Graphics Terminal	2,650	255	142	95
LN03	Laser Printer	3,295	316	176	119
TI					
TI707	Portable Data Terminal	$ 550	$ 53	$ 30	$ 20
TI820	Data Terminal PKG KSR	1,995	192	107	72
TI855	Dual Mode Printer	725	70	39	26
TI865	Dual Mode Microprinter	1,095	106	59	40
WYSE					
WY50	Video Terminal	$ 459	$ 44	$ 25	$ 17
WY75	Video Terminal	559	56	30	20
WY85	Video Terminal	559	56	30	20
PANASONIC					
FT70	Executive Partner PC	$1,999	$249	$139	$ 94
NRTHN TELECOM					
NT6K90	Displayphone Plus	$995	$ 97	$ 54	$ 37
CITOH & CIE					
CIT220+	Video Terminal	$775	$ 75	$ 42	$ 28
CI300	Matrix Line Printer	4,045	388	216	146
CI3500	Serial Printer	1,145	110	62	42

Call for special prices on: OKIDATA, EPSON, DATA GENERAL, ALTOS, NCR, APPLE and other popular equipment. PRICES GOOD TO DECEMBER 31, 1985
Full ownership after 12 or 24 months - 10% purchase option after 36 months

TransNet Corporation

1945 ROUTE 22 - UNION - N.J. 201-688-7800
1-800-526-4965 (Outside N.J.)
Offices in Philadelphia and New York City

CIRCLE 13 ON READER CARD

ANNOUNCING THE FIRST BUSINESS MODELING SYSTEM WITH ARTIFICIAL INTELLIGENCE

INGOT is the first DSS which simulates decision making of a chief financial officer to minimize capital costs. INGOT takes into account daily financial events, corporate policies, interest rates, and your business forecasts. INGOT's CASHMOD command makes simultaneous equations obsolete.

Other standard capabilities in INGOT give you more for your DSS dollar, including:

- PERT project management with automatic calendaring.
- Times series forecasting and advanced statistical methods.
- Flexible graphics for floor plans, maps and diagrams.
- Data entry with automatic validation and user defined HELP files.
- Optimization with linear and integer programming.
- Built-in financial and manufacturing models as commands.
- 100% of reference manual on-line for easy use.

INGOT runs on IBM MVS/TSO, DEC VAX, Prime, Tandem, DG AOS/VS, Apollo, CDC/NOS-VE, HP 9000, Honeywell GCOS, and most UNIX systems. Ask us about any others.

Get the Facts. Call **800-323-7820** or in Illinois 312-869-5556.

INGOT
SCHONFELD & ASSOCIATES, INC.
2550 Crawford Ave., Evanston, IL 60201

CIRCLE 14 ON READER CARD

package, followed by Ashton-Tate's dBase product at 9.2%.

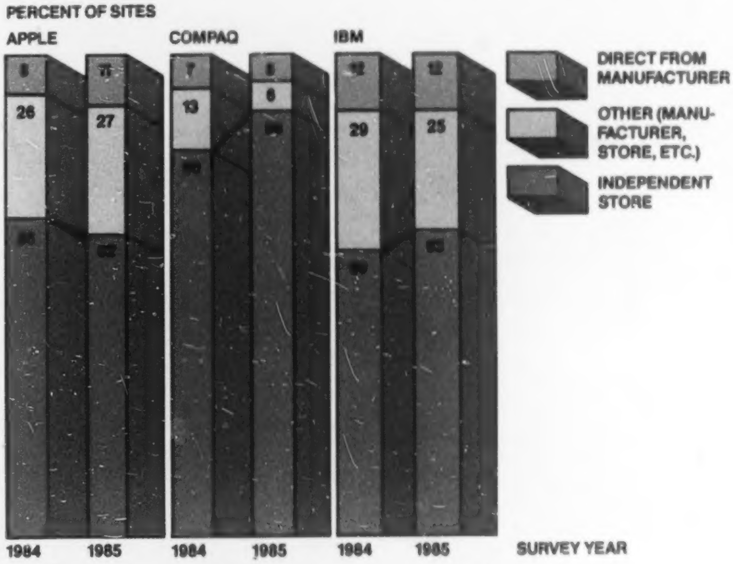
When it comes to pc hardware with an operating system, IBM is the hands-down winner. Of those sites that have chosen one or two standard suppliers, IBM was mentioned by three fifths of the sites, followed by Apple's 7% and Compaq's 6%, IBM winning even where another vendor is the major supplier of minicomputers: only 17.8% of DEC sites have standardized on DEC micros—52.6% have chosen IBM. In sum, IBM has captured more than half, 56.3% to be exact, of the sites with microcomputer installations. Apple is left with only 9.9% (down from 42% in the 1981 survey) and DEC with only 4.9%. IBM's share promises to grow to 62% next year, according to respondents' planned purchases; Apple's share will drop by a half, to only 5%. Compaq and AT&T will each gain, however, the former up 1% to 5% and the latter tripling its current 1% share. Of the more than 90,000 pcs purchased by survey respondents in the 18 months preceding the survey date, 53.1% were from

The few new pc users are, not surprisingly, choosing IBM as their main supplier.

FIG. 7

PRIMARY CHANNEL FOR PC HARDWARE ACQUISITION

Query: What is the primary channel through which your organization acquires its pcs?



• For DEC, HP and Wang, however, 60%± cite "direct from manufacturer" as primary channel

UNIVERSITY OF PETROLEUM & MINERALS
DHAHRAN - SAUDI ARABIA
COMPUTER SCIENCE AND ENGINEERING DEPARTMENT

The Department of Computer Science and Engineering will have faculty positions in Computer Science and Engineering open for the academic year 1986-87, starting 1 September 1986.

ACADEMIC QUALIFICATIONS AND EXPERIENCE:
Ph.D. in Computer Science or Computer Engineering or in a closely related discipline with emphasis in Programming Languages, Data Base-Organization and Structure, Microprocessors, Operating Systems, Data Processing, System Analysis, Digital Design, Computer Architecture, and Software Engineering, Micro-Electronics and Robotics.
The Department offers an undergraduate program in Computer Science and Engineering and a master program in Computer Science.
Computing facilities available include a computer-aided-instruction center based on an HP3000 and a number of microcomputers, a computer-graphics center with a VAX 11/780 and number of work stations in addition to IBM 3033 and AMDAHL 5850 and various minicomputers and microcomputers.

LANGUAGE OF INSTRUCTION IS ENGLISH.

Minimum regular contract for two years, renewable. Competitive salaries and allowances. Air-conditioned and furnished housing provided. Free air transportation to and from Dhahran each year. Attractive educational assistance grants for school-age dependent children. All earned income without Saudi taxes. Ten months duty each year with two months vacation with salary. There is also possibility of selection for the University's on-going summer program with good additional compensation.

Apply before December 31, 1985, with complete resume on academic, professional and personal data, list of references, list of publications, research details, and with photo-copies of degrees and/or transcripts, including home and office addresses and telephone numbers to:

UNIVERSITY OF PETROLEUM & MINERALS
HOUSTON OFFICE, DEPT. 309
5718 WESTHEIMER, SUITE 1550
HOUSTON, TEXAS 77057 USA

And Now, the Poster!

DATAMATION
IT'S NEVER DONE THAT BEFORE

DATAMATION
ON-SITE TELECOM BLOSSOMS
PORTS IN THE UNIX STORM
ASSURING QUALITY QUALITY ASSURANCE
HANDICAPPING LAN PLANS

Ten dollars buys an 18-inch by 24-inch, four-color reproduction of our June 15 cover. This exploded pc generated so many letters we just had to do it! Also available: a poster version of our March 1 "wire blossoms" cover.

To order, send a check ($10 per poster) made out to DATAMATION, with your name and address, to DATAMATION Poster, 875 Third Ave., New York, NY 10022. Please specify "June 15 Exploded Pc" or "March 1 Wire Blossoms."

DATAMATION

IN FOCUS

FIG. 8

PC APPLICATIONS SOFTWARE

Query: Which pc applications software package does your organization principally use now and which are planned for use (initially or additionally) in 1985/86?

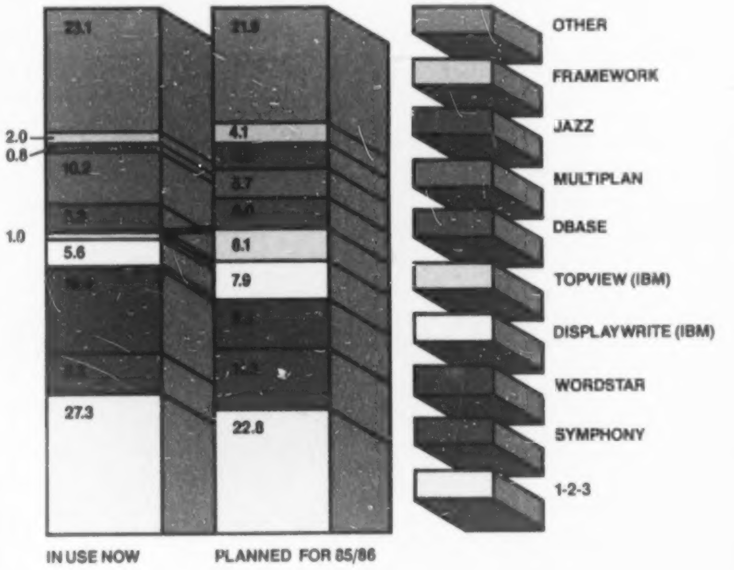
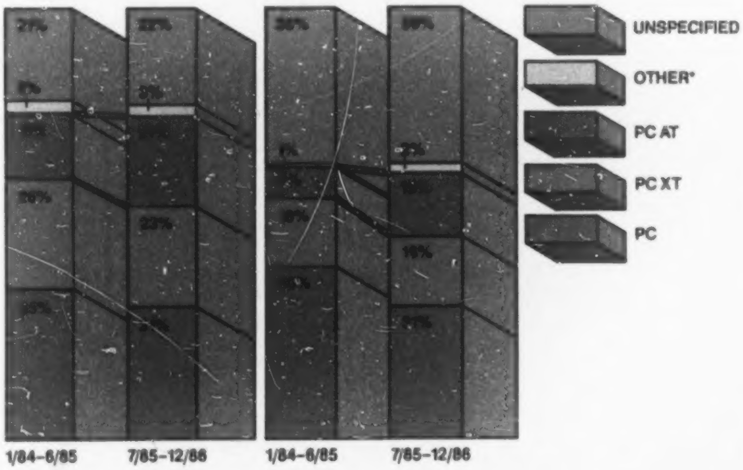


FIG. 9

IBM PC PRODUCT MIX

Query: How many personal computers were acquired by your organization during the past 18 months (1/84–6/85), and how many are planned for the next 18 months (7/85–12/86)?



*Principally 3270 PC

Note: PC/XT and original PC still comprise over half of respondents' personal computer unit buys from IBM.

Ronald Reagan

President Ronald Reagan

"U.S. Savings Bonds can mean a brighter future for you...and America." I'm appealing to *every* American to support the U.S. Savings Bonds program.

With today's competitive-rate Bonds, you can earn higher market-based interest *and* at the same time play an important role in America's growth and prosperity. Last year alone, U.S. Savings Bonds saved our Treasury nearly $2 billion. That's something every taxpayer benefits from.

Why not serve your country while you save. Buy U.S. Savings Bonds through your Payroll Savings Plan where you work. It's the way to build up your savings while you build a better America.

100
UNITED STATES SAVINGS BOND
100
SERIES EE

U.S. SAVINGS BONDS *Paying Better Than Ever*

IBM, 14.2% from Apple, 6.5% from DEC, and 4.4% from Zenith.

IBM will see the PC AT do well, that machine comprising 23% of the IBM PC units users plan to purchase in 1985-86; the original PC and XT versions will show a combined share of 73%. In terms of sites purchasing PCs, the AT will go to 21%, while the two previous models will go to 56%. The 3270 PC is still a low-volume product with this survey population, accounting for only 2% of planned unit purchases, or 3% of the sites.

Asked if they anticipated any major systems introductions by their vendors this year, 36% of IBM PC user sites answered affirmatively, down from the 48% recorded last year when the survey was taken just a month before the long-awaited AT was unveiled. This year's survey was taken just after IBM told customers that there would be no PC2 introduction this year.

The PC's importance to IBM showed in the fact that 62% of the projected mini/micro dollars to be spent with IBM by this year's survey respondents will go for PC equipment. Earlier this year, the DATAMATION/Cowen survey of IBM mainframe users showed that they would spend 28% of their IBM dollars for PC gear.

When it comes to pc hardware with an operating system, IBM is the hands-down winner with 60% of the sites.

As its overall market share has dropped, Apple Computer's product mix has changed. Only 19% of the specified Apple unit volume was Macintosh hardware, compared with 52% for the Apple II during 1984-85. But the following 18 months promise to see the Mac get 40% of Apple's shipments to these users, while the model II's share falls to 32%.

Peripherals purchases were down this year. In the under-20MB hard disk category, for instance, unit shipment growth over the previous year was only 12.9% (compared with the 219% measured in the 1983 survey), and in the 20MB to 100MB range, growth was 65.8% (down from 115% last year). Even worse were alphanumeric crt terminals, at minus 8%.

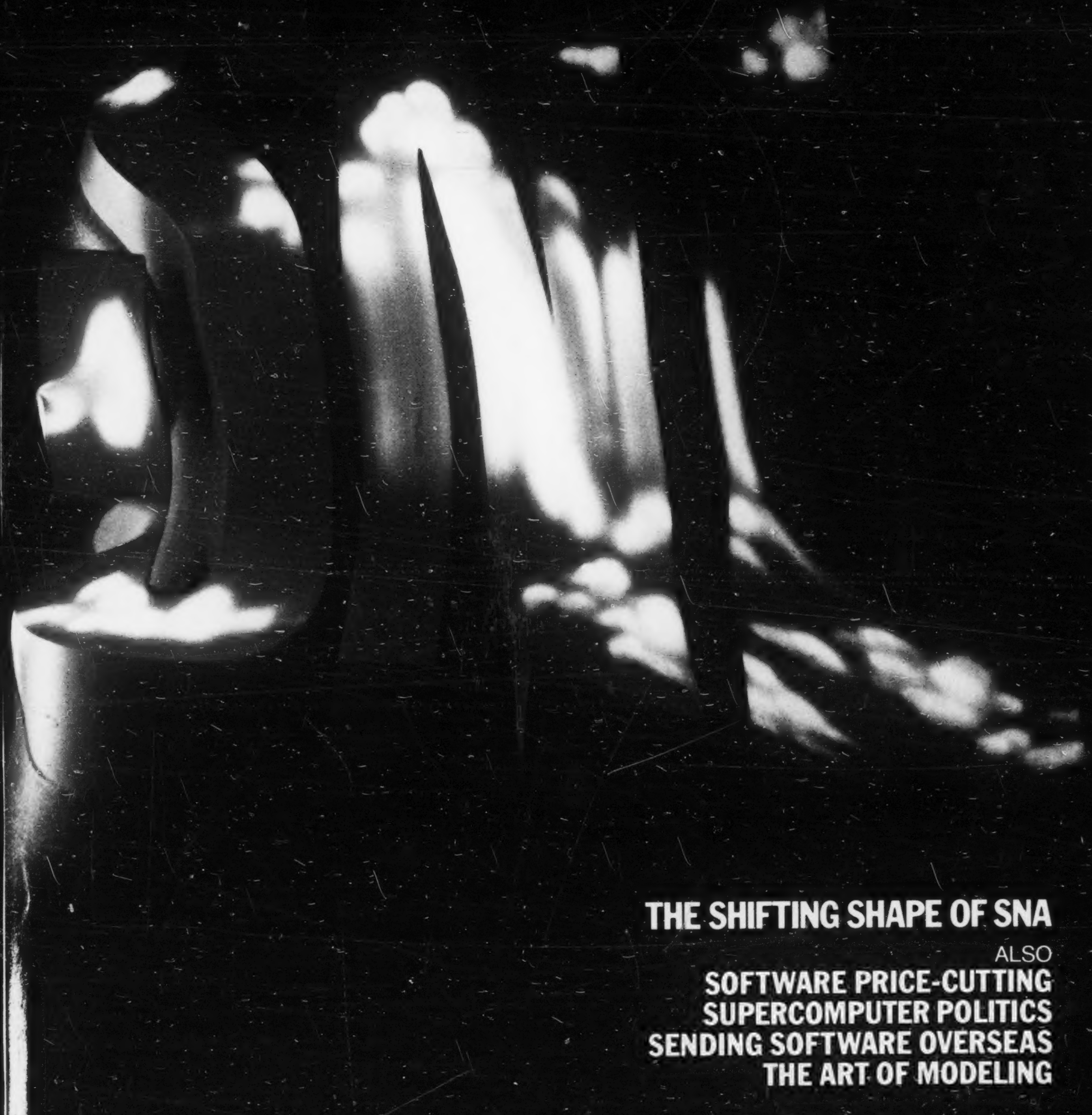
The microcomputer has made its biggest impact in commercial computing; it was the most frequently cited vehicle for new applications in that sector. Minis continue to be favored more heavily than pcs in scientific/technical computing. ◉

To order the complete 1985-86 DATAMATION/Cowen & Co. Mini/Micro Survey results for $795, please call Don Potts at (704) 568-5854.

C8650-1

DATAMATION

OEM EDITION NOVEMBER 15 $3 TECHNICAL PUBLISHING



THE SHIFTING SHAPE OF SNA

ALSO

SOFTWARE PRICE-CUTTING
SUPERCOMPUTER POLITICS
SENDING SOFTWARE OVERSEAS
THE ART OF MODELING

DATAMATION

NOVEMBER 15, 1985/$3 U.S.A.
VOLUME 31 NUMBER 22
This issue, 191,253 copies

FEATURES

30
IN FOCUS
Garbled messages on space shuttle display screens are just one indicator that there's still a way to go in "The Art of Space Software." Edward J. Joyce reports.

92
THE SHIFTING SHAPE OF SNA
John W. Verity
Systems Network Architecture keeps evolving. Can IBM's competitors maintain compatibility?

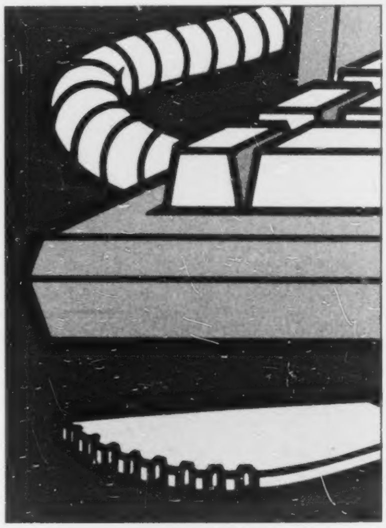
102
COMING: A NEW SNA
L. David Passmore
User requirements and IBM's strategic needs are changing; so is SNA.

114
PITFALLS IN DATA DESIGN
A.H. Wilson
Software tools do nothing for data design. You must structure the data so that the tools you have can work with them.

124
SENDING SOFTWARE OVERSEAS
David A. Wormser
A few general concepts of the new export licensing system, with a step-by-step approach for jumping regulatory hurdles.

133
ELECTRONIC MAIL SERVICES
H. Paris Burstyn
Anticipating a burgeoning market, vendors have developed or acquired E-mail services; waiting for costs to decline and friendliness to increase, users hesitate to sign up. Both end up frustrated.

140
THE ART OF MODELING
Joseph Bottom, Alan Bernard, and Kevin Anderson
Here's some help in evaluating microcomputer database managers for use in prototyping situations.



151
DATA INTEGRITY AND THE IDENTIFIER
Frank Sweet
A double dose of database design discussion, in parts eight and nine of a 14-part series.

NEWS IN PERSPECTIVE

38 **APPLICATIONS**
Wanna make a deal?

44 **SUPERCOMPUTERS**
Supercomputer politics.

52 **SYSTEMS SOFTWARE**
IBM's soothing balm.

64 **RESEARCH**
Picking up speed.

75 **SYSTEMS**
A shot in the arm.

84 **BENCHMARKS**

88 **WORLDWATCH**

DEPARTMENTS

8 **LOOKING BACK**
13 **LOOK AHEAD**
18 **CALENDAR**
23 **LETTERS**
27 **HARDCOPY**
60 **MARKETPLACE**
155 **HARDWARE**
163 **SOFTWARE**
170 **ON THE JOB**
175 **READERS' FORUM**
176 **ADVERTISERS' INDEX**

OEM SUPPLEMENT 88-1

OUTPUT DEVICES:

-4 **DISPLAYS**
-11 **VOICE DEVICES**
-12 **PLOTTERS AND PRINTERS**

COVER PHOTOGRAPH BY JAMES JOERN;
3-D ILLUSTRATION BY KATHY JEFFERS

OEM EDITION

Computers use a cornucopia of technologies to deliver their messages.

OUTPUT DEVICES

DISPLAYS

by Lamont Wood

It's easy enough to take displays for granted; they've served as the user's window into the computer system for as long as computers have been around. With a $4 billion installed value in the United States, today's terminal market is certainly mature, suggests Bob Sanekoff, a vice president with San Jose-based Dataquest Inc.

But new developments in these devices are cause for vars to sit up and take note. Innovative flat-panel screens on the market and the drawing board may better suit the needs of particular vertical markets. The alternative must be evaluated carefully, however, for each display technology has its drawbacks. Further, because the technology is new, its installed base value is less than $100 million, and perhaps not even $50 million, Sanekoff estimates.

The technology that seems to get the most attention is the gas plasma screen, which offers a display like a crt but is only an inch thick. Basically, gas plasma displays are neon lights in the form of flat panels rather than tubes. A grid of (transparent) electrodes is laid on either side of the glass, and wherever a horizontal line on one side and a vertical line on the other are both charged, the gas between them is ionized and starts to glow, creating a pixel (picture element) of light.

The industry is divided between alternating current (AC) panel makers, who are in the U.S., and direct current (DC) panel manufacturers, all in Japan. Donald Wedding Sr., president and chairman of one of the AC firms—Photonics Technology Inc. of Norwood, Ohio—predicts that AC panels will probably end up being used principally by the military, while DC panels will be used in commercial systems.

DC panels use mercury, a poison, so the military is nervous about putting them in submarines and tanks where they could leak into a confined space, Wedding explains. While the circuit drivers for DC systems are simpler and cheaper, making them more suitable for commercial use, the AC panels tend to be designed for large displays. And while AC panels have an expected life of over 20,000 hours, "it's under 10,000 for DC panels," Wedding adds, "and probably under 5,000."

The main trend in the gas plasma industry is vertical integration, with manufacturers providing the whole terminal rather than just the display panel, comments Joe Hoehn, manager of advanced programs at another AC plasma vendor, Electro-Plasma Inc. of Millbury, Ohio. At Lucitron Inc. in Northbrook, Ill., meanwhile, engineers are developing a gas plasma screen that actually works more like a crt. Alan Sobel, vp of operations, says his company can build not only any color screen (gas plasma screens are usually pink), but displays with gray scales, as well.

Instead of exciting neon to create points of light, Lucitron's grid excites the gas to emit electrons, which beat against a phosphor screen. The screen, in turn, emits light, just as a crt's screen does. "It's as if we had an electron gun for each dot on the screen," says Sobel. A gray scale can be produced by placing another charged grid between the first grid and the phosphor to control the flow of electrons.

Founded by a group of Zenith expatriates in 1978, Lucitron is just now glimpsing pay dirt, Sobel adds. The firm expects to start shipping demonstration units of its screen next year. The Lucitron official anticipates the "gas electron phosphor" display will find its niche replacing projection crts for group viewing, since the new technology lends itself to large screens.

In direct competition with gas plasma displays are electroluminescent (EL) displays. This industry seems to have a northern orientation, since the three firms that make EL displays are Sharp in Japan, a company called Lojha in Finland, and Planar Systems Inc. of Beaverton, Ore.

EL USES SOLID PHOSPHOR

Like gas plasma, EL uses an electrode grid to charge individual pixels. But instead of neon gas, the active material is solid electroluminescent phospor. Planar spokeswoman Kim Langeler says the company's standard

ILLUSTRATION BY JANE STERRETT

product has a resolution of 512 by 256 pixels, with a 640-by-200 or 640-by-400 screen available on custom order. The 640-by-400 screen is essential for IBM PC compatibility.

EL uses less power and is more rugged than gas plasma and won't freeze in the cold or collapse under high atmospheric pressure as liquid crystal displays (LCDs) may, says Langeler. But she adds that all EL makers have experienced problems achieving volume production, since the panels have to be made in "clean rooms." Planar's customers include the major automakers, which use them for dashboard displays, and the military. In fact, Planar, a spin-off of Tektronix Inc., has an R&D contract from the U.S. Army to develop multicolor EL displays for Army vehicles.

Grid Systems Corp. of Mountain View, Calif., also uses an EL display from Planar in its Compass portable computer, as well as a Japanese gas display in one version of its GridCase portable. "In terms of technical specifications, EL and gas plasma are fairly close," says Tom Humphries, hardware product marketing manager at Grid.

"They both have high contrast and a wide viewing angle. But, all things being equal, I think most people would prefer EL, since it has crisper dots," he says.

Grid chose EL for the Compass in 1982. At the time, the technology offered a resolution of 320 by 240 pixels; this was later increased to 512 by 256. When the time came to design the GridCase, "the people with plasma had the right format, price, and resolution," Humphries recalls. The GridCase also offers an enhanced LCD screen using blue-green letters on a yellow background. But even though the gas plasma version costs $600 more, it outsells the LCD version by a two-to-one margin, he notes.

Two of the principal objections to liquid crystal displays are that they have a narrow viewing angle and a slow response time. At Panelvision, a division of Litton Systems Inc. in Pittsburgh, engineers have addressed these objections with "thin-film transistor liquid crystal" (TFT LC) technology.

Tom Maloney, Panelvision marketing manager, explains that the basic idea is to put transparent electrodes on a glass substrate and cover an LCD screen with it. This allows each LCD pixel to be directly connected to its own capacitor. Since dynamic random-access memory (DRAM) circuits have a capacitor for each bit, he likens TFT to a screen-sized DRAM that allows you to see the state of the memory at a glance.

The TFT arrangement allows the liquid crystal to be "saturated" with current, improving viewing angle and response time. Panelvision was formed in November 1980 and acquired by Litton last June. The firm hopes to have a 640-by-400 display ready next year, and is already shipping panels with lower resolution.

FIG. 1

PERCENT OF VARS SELLING SPECIFIC OUTPUT DEVICES

	AS OF MARCH 1985	BY YEAR-END 1986
Touch display	11.4	24.5
Color plotters	29.5	44.1
Color printers	24.2	49.8
Voice output	8.9	27.7

Source: Based on a survey sample of 1,189 resellers conducted by the Yankee Group.

Zetec Inc. of Issaquah, Wash., is using Panelvision's TFT display in a portable metal scanner for the aviation industry. "Current LCDs just have so many drawbacks," says Pat Spencer, Zetec's director of engineering. "We needed low power for safety [due to the presence of explosive fumes] and a battery that would last eight hours without two Sherpas to carry it," Spencer adds. Zetec also required a high response time for its scanner—an MIZ20 Eddy Current Instrument device. The TFT display must still be lit for visibility in the dark, however, since it depends on ambient lighting.

As far as plain old liquid crystals are concerned, the action is centered around color. Larry Tannas, a consultant in Orange, Calif., and author of *Flat Panel Displays and Crts* from Van Nostrand Reinhold, notes that there are about 12 companies working on color LCDs—all in Japan. Two-inch color LCD tv sets are already on the market. The sets are two inches across, says Tannas, because "if they were any larger, you'd see how poor the resolution really is"—half the standard tv resolution. The Japanese predict, however, that they will have acceptable eight or 10-inch sets within two years. Color LCDs, incidentally, also involve TFT technology.

CRT ALSO GETS A FACELIFT

New developments are not restricted to flat-panel displays. The computer industry's old friend, the crt, is also undergoing a facelift, especially at Azuray Inc. in Scotts Valley, Calif. The two-year-old company recently began shipments of a crt with a resolution of 2,048 by 2,048 lines.

Bill Fenley, Azuray's president, explains that a conventional crt would need a bandwidth of about 400MHz to achieve that resolution. But the Azuray 2000 B/W accomplishes it with 50MHz using multibeam tube technology. The tube has eight electron guns, each of which scans the entire screen in parallel with the others, eight lines apart. The screens are regular size, with 17 and 19 inches being popular, says Fenley.

One of Azuray's first customers is Matrix Instruments Inc. of Orangeburg, N.Y., which makes parts for CAT and other medical scanners. "Azuray offers something that is otherwise unavailable—it's the difference between a useful picture and something that might just be pretty," says Bruce Laskin, vice president of strategic planning at Matrix.

"We wanted eight bits of gray scale, a 60Hz refresh rate to avoid flicker, and high resolution," he says. "We had found that 1,200 lines was not enough for diagnostic quality. Other vendors could barely manage 2,000 lines and had maybe only two bits of gray scale. But at 2,000 lines, Azuray is just starting out at the low end—they can add more guns if needed," comments Laskin.

As for quality, Laskin says his company has had doctors walk up to a display and try to peel off what they assumed was an X-ray taped to the screen. As much as 25% of modern radiological procedures involve digital scanning methods such as CAT scans and nuclear resonance scans, creating an obvious market for high-resolution crts, he notes.

Other possible display technologies include electrophoretic and electrochromic displays. Tannas explains that the first of these technologies involves using electrostatic fields to arrange dye particles suspended in a liquid. Electrochromic technology uses chemicals that change color when charged. But Tannas notes that little has been published on either technology in the last several years, indicating a lack of interest. ◉

Lamont Wood is a free-lance writer based in San Antonio.

As prices drop, more vars consider incorporating voice in their products for vertical markets.

VOICE DEVICES

by Esther Surden

When it surveyed 1,189 value-added resellers in March, the Boston-based research organization, the Yankee Group, got a surprise. Some 27.7% of the respondents expected to attach voice-output devices to their equipment by year-end 1986, compared with only 8.9% who do so today. Similar numbers of vars expected to incorporate voice output's sister technology, voice recognition, into their computers within the same time frame.

Although the Yankee Group survey did not explore how the vars planned to use voice output, the expected tripling of that market came as a shock to Yankee analyst Michael Goulde, who says he believes the vars are anticipating more from voice technology than they should reasonably expect. Similarly, consultants specializing in this field tend to be skeptical about the real growth potential for the voice-output market in the future.

There's no such pessimism from the manufacturers, however. One manufacturer, Votan, of Fremont, Calif., citing anonymous "independent market research firms," says that speech technology product sales will increase to $750 million a year by 1987 and predicts that during this decade, "verbal interaction with computers will become the rule rather than the exception."

Judging by the publicity they are putting out, both Digital Equipment Corp. and Texas Instruments—the two most vocal makers of voice equipment—are hot on the potential of this relatively new product, especially now that voice-output devices for personal computers are available. While DEC has stayed primarily with direct sales of its $4,000 DECtalk device, which uses an ASCII interface to hook up to any computer, Texas Instruments, for one, sees the value-added reseller as a natural way to market its IBM PC-compatible device, which sells for $995 and comes complete with a host of development tools.

Several relatively new companies are courting vars as well. Votan, in the market since 1982, and Roswell, Ga.-based Innovative Technology Inc.—both of which have developed peripheral circuit boards and software for IBM PCs and compatibles—are asking vars to design related voice applications for their units. In single-unit quantities, ITI's Nita product costs $1,995. An applications development kit runs another $500. Supplying both speech input and output devices, Votan offers its VPC 2000 plug-in card for the IBM PC for $2,450 in single-unit quantities, a price that includes telephone management software.

Current generation voice-output devices generally come in two flavors—digitized voice and voice synthesis. Digitized voice converts spoken words into information that can be stored, retrieved, and replayed by a computer system and is similar to tape recording. Before digitized voice could become economical, researchers had to work on voice compression software techniques that allow only key features of ~~speech to be~~ stored on computer disk so as not to take up too much room. Thus, speech normally transmitted at 64Kbps can be compressed to 2,400bps and played back so that it sounds intelligible. Texas Instruments is the key developer of the TMS320 signal processing chip, which has been used in many of these devices.

Voice synthesis converts ordinary ASCII text into understandable speech, so that particular information from a database can be "read" to a user over the phone. While digitized voice relies on prerecorded messages or phrases, voice synthesis systems use linguistic pronunciation rules to create speech, and thus requires many hours of basic linguistic research before understandable speech can be created.

Larry Drinkwater, DEC's marketing manager for voice technologies, notes that the intelligibility of synthesis devices has improved over the past few years, making synthesis a viable product in today's marketplace.

NOT ALL SEE ROSY FUTURE

While all the companies are quick to cite situations in which vars could fit their systems with voice, not all industry observers believe that the market for voice output has much place to go in the near future. Amy Wohl, an office automation consultant based in Bala Cynwyd, Pa., says, "All the applications in the office in which a computer talks back to the user depend on the system's ability to mimic natural speech. It's not real interesting when it's just reading you something out of a vocabulary of a few hundred words." Much software has to be written and many breakthroughs in the cost of high-level processing will have to take place before these kinds of applications will be commercially feasible, Wohl suggests.

Dan Carter, vice president of the strategic business service unit at Walter Ulrich Consulting of Houston, agrees there are many office applications in the distant future. He adds, however, that the most promising areas of use for voice systems are those in which both eyes and hands are busy—airline pilots during certain landing procedures and inspectors of industrial systems are two examples. In the latter, voice output and voice input are combined to allow the inspector freedom of movement.

Votan has been quite active in this market, says Bruce Ryon, manager of marketing communications. Voice output is already being used successfully by the handicapped. One famous example is the Kurzweil reading machine in which voice synthesis is used to read books to the visually impaired.

A key reason why vars are moving toward incorporating voice in their systems is economics, says Texas Instrument's Doug Palmer, product manager for TI Speech. Suddenly, applications that might have seemed like pie in the sky two years ago are affordable to market.

Costs have fallen dramatically over the last two years so that "we now have speech hardware that is reasonably priced," says Palmer. "When TI introduced the Speech Command System in 1983, the list price was $2,600; when we introduced our second generation system, TI Speech, in March of this year, the price had dropped to $995. The var can now supply an application on a system that is much more cost-effective than if he had to spend $2,600 on every speech board." TI has also worked to improve software development tools, he adds. "You can't just say 'here's text-to-speech'; you have to make it reasonably easy for a var to include text-to-speech in an application."

To encourage vars to use the speech units, TI has set up a special discount program for this product line, says Palmer, and has improved production of the units so they can be shipped multiple times without failing. To let vars know what they have to offer, TI shows up at American Voice Input/Output Society and Speech Technology trade shows.

Innovative Technology has selected Comdex as the show of choice to reach vars. Says Gary Hylton, director of sales and marketing for the startup company, "One of the unique ways we support our vars is through the inclusion of a simulation program written in C language that vars can port to any machine. They can then work up their applications and instead of worrying about having to test it with real telephones, they can run it in simulation." Innovative Technology has about 12 vars signed up right now. Hylton also notes that the firm offers telephone consultation time, some example applications, and access to ITI's DEC VAX computer for electronic mail, so that messages can be sent to its support personnel any time of the day or night.

Texas Instrument's Palmer says

Color output remains tied to specialty rather than general business applications.

that voice applications in the office have lots of room to grow. One especially promising area is in the inquiry of databases by people who are on the road a great deal and don't want to carry a computer terminal but do want access to data. "To be able to use the telephone as your sole device to access data will be really important," he says. DEC's Drinkwater points to electronic mail as another example. With voice-output devices installed on their computers, users who travel out of reach of a terminal can retrieve the text of electronic mail via the telephone: the system reads their messages to them.

ANOTHER GROWTH AREA

Computer training is another office automation growth area, Palmer believes, citing the example of Indiana Bell, now a Texas Instruments VAR that uses TI Speech in TI Professional Computers in training employees in its distribution department to use a mainframe program to assign service orders. Spoken instructions accompany the text. The personnel department found the voice application so successful that it developed and marketed an authoring system based on voice technology, says Dean Ellis, manager of personnel.

Ellis's experience is typical of the VARs in this field who simply fall into the use of voice output rather than set out to design an application for it. "The dealer didn't know if it would work, and the people at TI in Texas said they would let me play around with a board for a while to see if it would work. It did," he says. The new economics of digitized voice and the good quality achieved were key to the system's success, Ellis adds. Users can recognize the voice accompanying the text, and the $995 board "more than pays for itself in the reduction of board and lodging required for a trainee to come to a central location and receive personal instruction."

Officials at Invocom in Hopkinton, Mass., began their experiments with this technology by providing voice mail systems through minicomputers, but quickly found that this field was very crowded. The solution: to branch out. Now Invocom is involved in selling IBM PC-compatible systems to banks and school systems. The banks use the voice-output devices to provide balance and other account information to their customers, while the school systems alert parents of children who have not shown up for class.

According to President Dan Perti, the company recently became a VAR for Innovative Technology because that firm provides more functionality on its board than its competitors. Perti also likes the fact that ITI has its boards made, tested, and shipped at a single original equipment manufacturer, eliminating some possibilities for reliability problems and the consequent finger pointing. The fact that the price of voice boards fell over the past two years has helped the firm remain competitive in what Perti views as an increasingly competitive market for voice. "We are really seeing a proliferation of suppliers of these systems and an increased awareness in possible applications for voice," he notes.

AutoComm of Santa Monica, Calif., is a TI VAR that began by addressing a specific application and then expanded. "Our software was designed around the TI speech board and transforms an IBM PC AT, XT, or compatible, or TI Professional or Portable computer into a speech management system," explains Cecilia Pfeiffer, vice president for sales. "The user keeps telephone directories to be called. A message, prerecorded through a microphone, telephone, or headset, is converted from analog signals to digital signals, compressed, and stored on hard disk until the message needs to be played back. The user selects the time for the AutoComm Messenger to start calling and a time to stop, and the unit works unattended."

The founders of AutoComm began by working with another TI VAR developing student administration software and found a need in school systems for mass calling of parents. Says Pfeiffer, "We wrote the design document at our former employer and wound up buying it from them and starting AutoComm." The firm started only in the education marketplace and has had excellent response from school districts and parents. "We do recommend that people do some public relations work in the community." A letter sent to parents informing them that the system would be used went a long way toward winning cooperation.

Price of the board really hasn't been a factor in selling the system, says Pfeiffer. This is because older, robotic tape recording systems that also do mass callings, but are not integrated into the computer and so can't access the database, tend to be higher priced. ◉

Based in Guttenberg, N.J., Esther Surden has written about the computer industry for 12 years.

PLOTTERS AND PRINTERS
by Dana Blankenhorn

Two truths in the world of printers and plotters are 1) color communicates better and 2) color printers and plotters have been around for years. In spite of these truths, the majority of the graphic output produced by American business today remains resolutely black-on-white.

That's changing. In fact, Peter Testan, who studies the color hardcopy market for research firm C.A. Pesko Associates Inc., Marshfield, Mass., calls 1985 "the year of color." He estimates total sales of color printers and plotters will increase to $5.96 billion annually by 1989, against $1.27 billion in 1984.

"By the end of 1985, there will be an installed base of over 1 million color hardcopy products in the U.S.," he adds. "This significant number of installed color hardcopy products will foster a color revolution in all areas of business and technical communications."

Testan's report is a call to arms for vendors of color plotters and printers, but Hedy Taub of Future Computing Inc. points out that, outside the scientific and engineering labs, graphics in American business is still a matter of black and white. In a study of printers completed last April, the Dallas-based market research firm commented, "We expected the 1985 market share for all color printers will be 4.7% of the total. In 1986, it will be 7.3%; in 1987, 11.1%; in 1988, 15.7%; in 1989, 20.5%; in 1990, 25.9%. This is in percentage of units sold, not dollar amounts." It doesn't take a colored graph to see that color output's future is all in front of it.

Why has color output still not caught on in America's executive offices? Until recently, color reproduction was stuck on the wrong side of trade-offs involving speed, resolution, cost, and standardization. Color ink jet printers could produce five to seven pages a minute, but their resolution was low and their prices high.

The same problem was seen in color dot matrix printers. Color thermal-transfer printers like the Okidata 10 and 20 were considered more capable, but also more prone to breakdowns. Color plotters produced high resolution, but worked slowly. Standards for communicating a color message between software and color printers did not exist in the real world.

Charles Muench has been around these trade-offs as long as anyone. A decade ago, he built and sold the first color computer, CompuColor. His PrintaColor Corp., a Norcross, Ga., company, makes color ink jet printers, and now his Colorocs Inc., also of Norcross, has a color copier ready for manufacuture. (Intelligent Systems Corp., another Muench-founded company, is a leader in color terminals.)

Muench believes a color copier is

It doesn't take a colored graph to see that color output's future is all in front of it.

the last link in the chain that can bring the whole business world into color. "It's reached the point of what comes first, the chicken or the egg. You can't have lots of color output unless there's a way to copy it. And there's not much demand for a color copier without color output to copy."

To get that color output, of course, you need a software driver that communicates with both the output device and your graphics software. Data Transforms Inc. in Denver sells a color graphics package called Fontrix, and vice president Duke Houston says each printer it works with still needs its own driver. "Some printers go with a byte that's horizontal instead of vertical. With each printer, you're looking at a different placement of dots," he notes.

"There are multiple ways of addressing all those little colored dots, and I don't think there's been any standardization," says Ed Juge, director of market planning for Tandy Corp., Forth Worth, Texas. "We have a color ink jet printer selling for $695, but it's not a hot seller because outside of a few packages we have that drive the thing, there's nothing out there." Unless a printer or plotter works with the applications businessmen already have, Juge adds, "businessmen won't buy them."

IBM'S PRINTER SOLUTION

When IBM announced its $745 Color Jetprinter last summer, the company tried a brute force solution to that problem with a list of compatible programs. IBM products like Chartmaster and outside products like Lotus's 1-2-3 and Ashton-Tate's Framework were on the list, says IBM spokeswoman Adrianne Singer. But only new versions of those products have the driver; owners of older versions must be upgraded to conform to Jetprinter specifications.

Before any software package can work with a specific printer, she says, "you have to look at the resolution of the printer. If you have printers with different resolutions, you must have a different driver. Different technologies, different resolutions warrant different drivers."

Another way to drive color printers is to install the driver in the operating environment. That, at least, is the promise of Windows from Microsoft Inc., Bellevue, Wash., and GEM from Digital Research Inc., Mountain View, Calif. Once these environments are configured to a printer, applications should run smoothly under them. Producing these programs has been much harder than talking about them, however. Both came out late, and GEM users were still burning up the phone lines to DRI with bug reports in September.

That leaves the option of putting the driver in the application. Common application packages like Lotus 1-2-3 are now being shipped with a set of drivers for common color printers and plotters. Lotus's drivers "will create an 8½-by-11-inch plot on any of our current drivers," says Margaret Lewis, manager of technical services for plotter manufacturer Houston Instruments, Austin, Texas.

This solution, however, is not perfect. "Some of our plotters use bigger paper, but Lotus doesn't let you use it," Lewis explains.

Another way to address the problem is by standardizing the hardware. "We've been working hard with our software vendors to get them to use our Digital Micro Plotting Language (DMPL), and it's been very successful," says Lewis. Over 250 software packages understand DMPL, she notes, including 1-2-3, and all Houston Instruments plotters use the same protocol.

Meanwhile, those hardware tradeoffs are becoming less onerous, as well. Plotters are getting faster, new printers have better resolution, and all equipment is getting less expensive. As a result, says Ray Habibi of Ace Computer Centers Inc. of Marietta, Ga., a Hewlett-Packard dealer, he's opening new plotter markets.

"This traditionally belonged to top-level executives in Fortune 100 corporations," Habibi says, "but now we see mom-and-pop type accounts getting in there. They find it a lot easier to show a pie chart than a whole lot of numbers."

There are still many choices that must be made in selecting a color output device, however, beyond choosing between a printer and a plotter. It it's a printer, do you want a dot matrix, ink jet, or laser printer? If it's to be a plotter, do you want a pen plotter or a new electrostatic plotter, which offers higher resolution and faster speed but at a much higher price? Often, the only way to sort through these choices is with the help of a value-added dealer or consultant, which raises the system's total price.

The choices can be bewildering, if sometimes beguiling. Plotters start at under $1,000 for products like Houston Instrument's single-pen DMP-40, going up over $20,000 for electrostatic plotters such as the Versatec ECP-42. IBM ink jet printers can be had for $745, and NEC dot matrix color printers cost even less. Perhaps the toughest task is to make a choice that will be supported by new software in the long run.

Bruce Thatcher, director of marketing for NEC, which sells only dot matrix colors printers in the United States, says improvements in quality will help those products win out over plotters. "We think resolution in the range of 300 dots per square inch is where the market will evolve, so that you can get very finely shaped characters and smooth, rounded surfaces."

SITUATION UNCHANGED BY 1990

Future Computing, which looked at the entire printer market—not just color—expects that laser printers, ink jet printers, and thermal-transfer printers will all gain in the next five years at the expense of dot matrix and solid font (typewriterlike) printers. Even in 1990, however, the question of which technology to use will still be open: solid minorities will still be buying each type.

Perhaps as a result of all this confusion, the business graphics market hasn't taken to color as its boosters might like. "To be honest, we're not selling too many of them," says Al Soskin, a store manager for Future Information Systems in Atlanta. "I don't think there's much of a market."

Soskin continues: "Let's take the average business. What do they use the printer for? Correspondence. Are you going to read a letter in red, green, and blue? I don't think you'd be happy with it. Black and white does the job every time, and it's less expensive.

"There are applications for color printers in CAD/CAM," he adds. "So yes, we're selling some HP plotters, and we do have the IBM Color Printer, but maybe we sell one per month," usually through a salesman specializing in engineering markets. "For those specialty VARS, I could see a market." But not for business graphics.

Even among state-of-the-art users, color remains a frill. At Hayes Microcomputer Products Inc. of Norcross, Ga., color graphics are restricted to training and product development; printers in the executive suites are still monochrome.

So computer aided design remains the most popular application for business plotters. And pen plotters from Hewlett Packard and Houston Instruments have the leading market shares. (Even IBM sells the HP plotter on an OEM basis.)

We're left with the statement we began with. Color communicates better. But how much color, in what form, with what resolution, on what software, and for how much? Before predictions of glory are realized, business users will demand answers to these questions. ◉

Dana Blankenhorn is a free-lance writer based in Atlanta, and is president of the Computer Press Association.

DATAMATION

INTERNATIONAL EDITION DECEMBER 1 - $3 TECHNICAL PUBLISHING

SYSTEMS SOFTWARE

ALSO

DOING THE NEWS WITH CPUS

AMDAHL'S OS FIZZLES

PARALLEL PROCESSING'S PROMISE

DATAMATION
DECEMBER 1, 1985/$3.00 U.S.A.
VOLUME 31 NUMBER 23
This issue, 192,328 copies

FEATURES

22
IN FOCUS
All three television network newsrooms and some 50 local tv stations are "Doing the News with Cpus," reports Gail Gregg.

72
WHITHER VM?
Dale Kutnick
The answer isn't so difficult: it will be the cornerstone of IBM's mainstream departmental and distributed systems strategy.

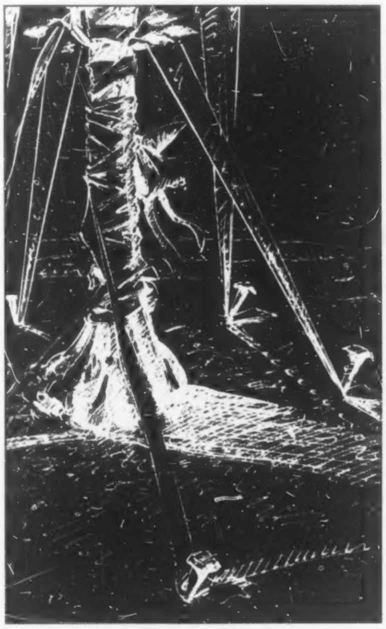
83
DATABASE: WHAT'S IN STORE?
Robert M. Curtice and William Casey
What will be the technology and the products during the next five to 10 years? Here's an answer based on the demands and inertia of the marketplace, the current research and development, and the history of the last 15 years.

93
PARALLEL PROCESSING: FACT OR FANCY?
Omri Serlin
It promises to provide solutions to problems beyond the reach of conventional computer technology, as well as speed up, by orders of magnitude, solutions to current problems. But where do you find it?

109
SIMON SAYS . . .
Kurt A. Christoff
There are any number of Simons out there, each with words of wisdom to help you move forward into the brave new world of the information age. There is much wisdom to be found in their words; there is also much folly.

117
PAST AND FUTURE EVENTS
Frank Sweet
Parts 10 and 11 of a 14-part series on database design.

NEWS IN PERSPECTIVE



30 **OPERATING SYSTEMS**
Eulogy for Aspen?

32 **SERVICES**
Chicken and egg.

38 **NETWORKS**
Bits and pieces.

47 **MICRO SOFTWARE**
A moving target.

54 **DIVERSIFICATION**
Back to the basics.

64 **BENCHMARKS**

DEPARTMENTS

9 **LOOK AHEAD**
15 **LETTERS**
19 **EDITORIAL**
121 **PEOPLE**
127 **HARDWARE**
135 **SOFTWARE**
142 **THE MARKETPLACE**
143 **SOURCE DATA**
149 **READERS' FORUM**
152 **ADVERTISERS' INDEX**

INTERNATIONAL 68-1

-2 **DP PROS: WHAT ARE THEY WORTH?**
-11 **TRAINING IN TOKYO**
-17 **AN AFFAIR OF STATE**

COVER PHOTOGRAPH BY TOGASHI

Continental companies are offering bountiful bonuses and benefits to attract the right recruits.

DP PROS: WHAT ARE THEY WORTH?

First, the good news. Skilled data processing professionals are very much in demand in Europe, especially if they have networking, database, or on-line systems experience. There are more job openings than ever for these pros at Continental corporations that put a high value on high tech. So high that they are willing to offer bountiful bonuses and benefits to attract the right recruits.

Now, the bad news. The party's over for European dp personnel who are used to pulling in fat salary increases each year. Those massive raises have become a thing of the past. "The industry simply isn't willing to pay outrageous salaries for dp people any longer," says Franz Czap, dp chief at West Berlin electrical firm Osram.

Smaller salary increases in the dp sector are evident in almost every European country. In West Germany, top dp managers saw their wages remain almost static in 1985, according to reports from the staff recruiting division of market researcher Kienbaum in Gummersbach. Kienbaum found that while the senior dpers in 318 companies earned only 1% hikes, other more junior dp managers received an average salary boost of 3.3%.

In France, Sema Sélection, a recruiting consultancy in Paris, surveyed 220 organizations only to find that dp salaries had risen a scant 2.9% in real terms during 1984. Across the Channel in London, Computer Economics talked to over 400 companies to discover that dp wages in the U.K. were up 7.6%. That's a paltry increase compared with 1980, when the average British dper was hauling in enormous 27% raises.

So what has changed? Well, the role of data processing, for one thing. The dp function has become more integrated into the overall structure of European organizations. And as a result, the skyrocketing salaries of data processing pros have been brought down to earth and brought in line

ILLUSTRATION BY DAN ADEL

In France, the demand for programmers, systems analysts, and data entry people is down.

with other corporate positions.

"Data processing staff are now paying for the inflated merit raises in the past," says Peter Stevens of Computer Economics. "These increases took them to the top of their companies' salary grade structures and now there is nowhere else for them to go."

Osram's Czap agrees. "These natural limits have stopped the vicious spiral of rising dp salaries." That spiral was winding right to the top. "Due to the expansion of the dp role in the company," observes Erhard Schmidt, a project supervisor with Kienbaum, "the director of MIS or dp has established a position right below the top management."

Caroline Bagley, managing consultant in the major accounts division of the international recruiting company Computer People, in London, believes that companies that have more hands-on experience with computers are getting more pragmatic when it comes to paying dp personnel. "Dp is now very much a part of the corporate structure," she explains. "Some of the mystique of dp is disappearing. Financial directors are getting more involved than ever before in computing and they are taking a realistic approach to salary increases."

Bagley also sees evidence of belt-tightening. "The recession has had an effect on budgets," she says, "and companies are more restricted in the salaries they can offer. That makes finding new people a difficult task. So, to entice the best dp employees, firms are offering a host of other benefits.

"There are lots of executive perks—like stock options schemes, expensive cars, large expense accounts, and bonuses—to be had, particularly for senior dp staff." Sometimes those bonuses can be substantial. The Lambeth area council in London, for instance, offered new workers a bonus of up to $3,500 to join its dp team.

In Scandinavia, the focus is also on fringe benefits, but for different reasons. In Sweden, for example, people who earn more than $35,000 a year find their incomes eaten up by taxes. This taxing situation, according to Martin Edin of headhunter Marknadsrekrytering in Stockholm, makes perquisites a prerequisite for dp job seekers. The same holds true in Norway.

All these employment extras, however, aren't making it any easier for Continental companies to find the right dp personnel. There's an acute shortage in Europe of dp professionals who have the experience firms need. The U.K.'s National Computing Center estimates that the British dp industry needs roughly 20,000 more computer pros. In particular demand are programmers and systems analysts who have experience in real-time systems, communications, and database software.

FIG. 1

EUROPEAN DP SALARIES*

	FRANCE	W. GERMANY	U.K.
Dp Manager	43,000	44,000	35,500
Operations Manager	26,500	26,000	24,000
Chief Systems Analyst	25,500	25,000	24,500
Programmer	15,500	19,500	14,500
Senior Operator	15,000	17,000	16,500

*Average salaries in dollars as of spring 1985
Sources: Sema Sélection, France; Kienbaum, Germany; Computer Economics, Britain

W. GERMAN SHORTAGE ACUTE

The situation is even worse in West Germany, where 30,000 dp people are needed, according to the national job market and labor research institute in Nuremberg. And while there are dp workers available, many of them lack the practical background that companies are looking for. "We are happy if only two applicants meet our requirements when we're recruiting," Osram's Czap says resignedly.

The French are also having trouble getting experienced dpers. Jean-Paul Menassier, director of Sélé-Cégos Informatique, reports that there's been a 6% increase in the number of unfilled dp job slots between 1984 and 1985. "When you analyze this overall figure," he explains, "you find there has been a fall in the demand for programmers and systems analysts, as well as for data entry people. While the demand for operating staff is stable, the demand for systems engineers and project leaders has risen."

Bernard Beaunoir, a senior consultant with Sema Sélection, believes that "the main shortage is with technical support staff, systems engineers, and networking specialists. There's also a particular need for project leaders aged 28 to 30 who have a good five years' experience behind them."

Beaunoir sees dp staffs becoming smaller but better qualified. He also puts networking and database experts at the top of the list of dp desirables. Camille Cassin, a director of Dataid Sélection, adds info center specialists to that list.

While most user companies want trained people, they are unwilling to do any training themselves. "There are fewer than a third of the firms we survey that employ any trainees at all," declares George Penney, the NCC's careers project manager. Computer Economics' Stevens also comments of the training conundrum, "Companies embarking on new projects need experienced staff, of course. But existing installations could rely more on training."

The problem is that it costs up to $9,000 a year to knock a trainee into shape. Adding those costs up, companies are reluctant to take on raw recruits. "There are companies," says Stevens, "that employ 50 graduates and then find out 14 months later that 40 of them are gone."

The British government, determined to tackle the training question, has set up the Information Technology Skills Shortage Committee. Headed by junior industry minister John Butcher, the committee has asked the Confederation of British Industry (CBI) to suggest ways to solve the skills shortage problem. The CBI in turn has established the Information Technology Skills Agency, which is supposed to make sure that universities and colleges turn out graduates who are better qualified to enter the dp industry.

CBI will use its $58 million budget to produce more graduates with dp and engineering skills. The task force will also try to persuade industry to take over some of the training chores. "There is no doubt that there is reluctance on the part of some companies to train their people," notes Stewart Judd, deputy director of the CBI agency.

Judd also cautions companies about hiring graduates who are overqualified for a particular dp job. "If [companies] recruit highly qualified people for routine work, they are going to be in trouble," he warns. "You don't need highly skilled people to maintain [an installation]."

Further up the dp career ladder, skills become very important. But being technically competent is no longer enough, as Dataid's Cassin points out. "There are plenty of dp staff on the market, but there's a lot of waste because companies are very demanding," he says. "They want dp staffers who are not only technically able, but also have a great human potential. That's because there's a growing trend for dp staff to move into other managerial positions in their corporations. They're not only going into production management, where dp skills are of particular value, but also into general management."

MORE THAN COMPUTER EXPERTISE

Menassier of Sélé-Cégos also agrees that companies want more than computer expertise. "Employers now ask for dp experience plus managerial or production experience," he says. "There are still traditional dp jobs, but there are many new ones too, especially in the field of networking." He predicts that "network engineers have a big future."

Scandinavian firms also want a new breed of dper on their payrolls. Norwegian headhunter Hans Petter Lauritzen in Oslo reports that companies in his neck of the woods "want their dp managers to be more people managers than before. The dp background is still important, but they also want people with an overview and a vision. The dp manager must be able to inspire and motivate people and to convince top management. So, generalists tend to get the best jobs."

Data processing people are demanding more from their jobs too. "Dp people are putting a lot more emphasis on the professional environment in their new jobs," says Lauritzen. "They don't want to lose touch with the forefront of dp development. They want to continue growing. Because of this, large companies tend to get hold of the best candidates. The smaller ones often lose out."

The dp community in France shares the sentiments of the Scandinavians when it comes to its job. "What interests dp staff in particular," explains Sélé-Cégos director Menassier, "is the quality of the project they are going to work on and the technical experience it will give them."

In France, as elsewhere, dpers are still relatively mobile, changing jobs more frequently than most other professionals. But that job-hopping seems to be slowing down. "There are even some programmers who stay in a job for more than a year now!" quips Menassier. Staying even longer seems to pay off. "Instead of moving on to new pastures, people are tending to stay put, because there is little incentive to move," according to Computer Economics' Stevens. Stevens' research shows that programmers who remained in the same job were rewarded with raises that averaged 12%, well above the overall average for U.K. dpers.

The payoffs can be even greater in a big company. Kienbaum's Schmidt says that a dp manager in a large West German organization may earn $49,000 for the same job that may go for $34,500 in a smaller firm. These salary discrepancies between the mighty and mini companies are repeated all over Europe. In France, for example, large companies pay up to 20% more than small ones for dp pros, while in Britain, the differential is two to one.

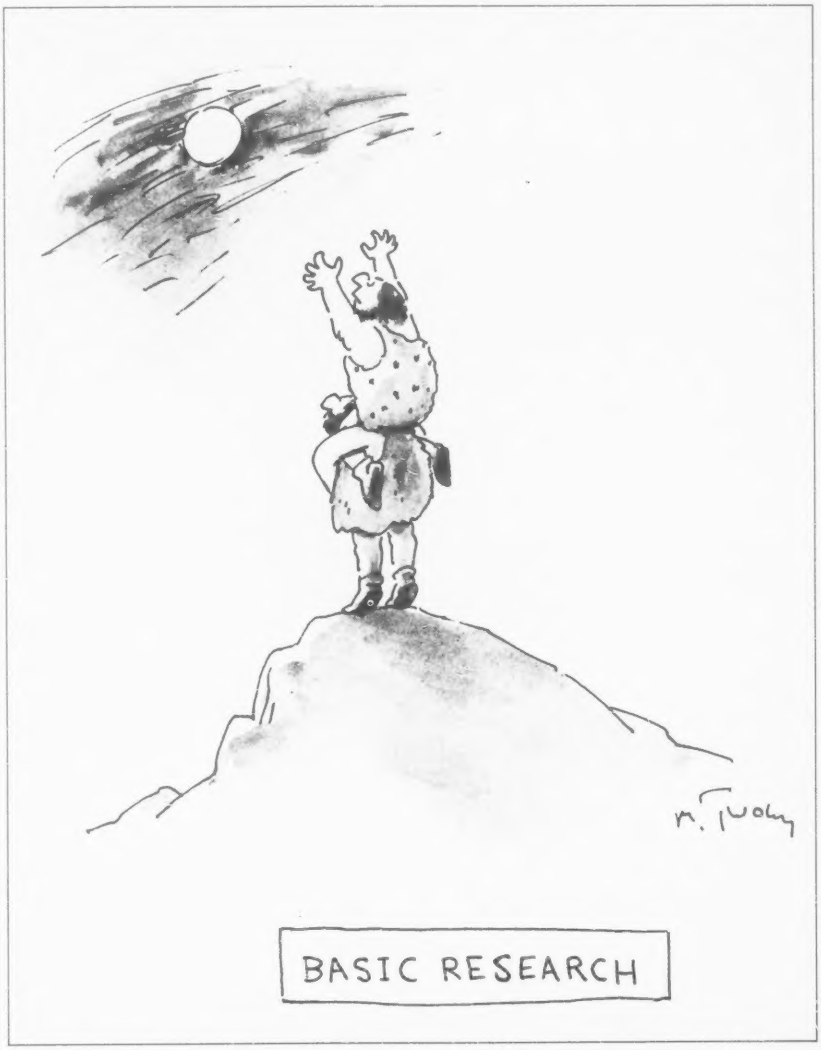
That leaves medium and small-sized Continental companies in dire straits when it comes to securing the services of skilled dp workers. Hoping to lure some seasoned staffers away from the larger firms, these companies may offer these coveted candidates more responsibility, more management status, and, alas, more money. The big boys will naturally fight back, making their perks more persuasive and their salaries more salubrious.

There are already indications that the salary scene is indeed brightening for European dpers. Computer Economics reports that wages inched up slightly in Britain in 1985, the first time salaries have been on the upturn since the late '70s. Managers and development personnel, who had lagged behind the rest of the industry for the past few years, seem to have done the best. In West Germany, some companies are complaining that they'll have to offer dp specialists 20% more than the going rate if the job situation there doesn't improve.

If these twitches in the indicators turn into a trend, then it won't take long to spread across the Continent. For Europe's dp professionals, another party may be coming. ◉

Contributing to this article were James Etheridge, Peter Hidas, John Lamb, and Paul Tate.

CARTOON BY MIKE TWOHY



DEC

15

1985

DATAMATION®

85
OEM EDITION DECEMBER 15 $3 © TECHNICAL PUBLISHING

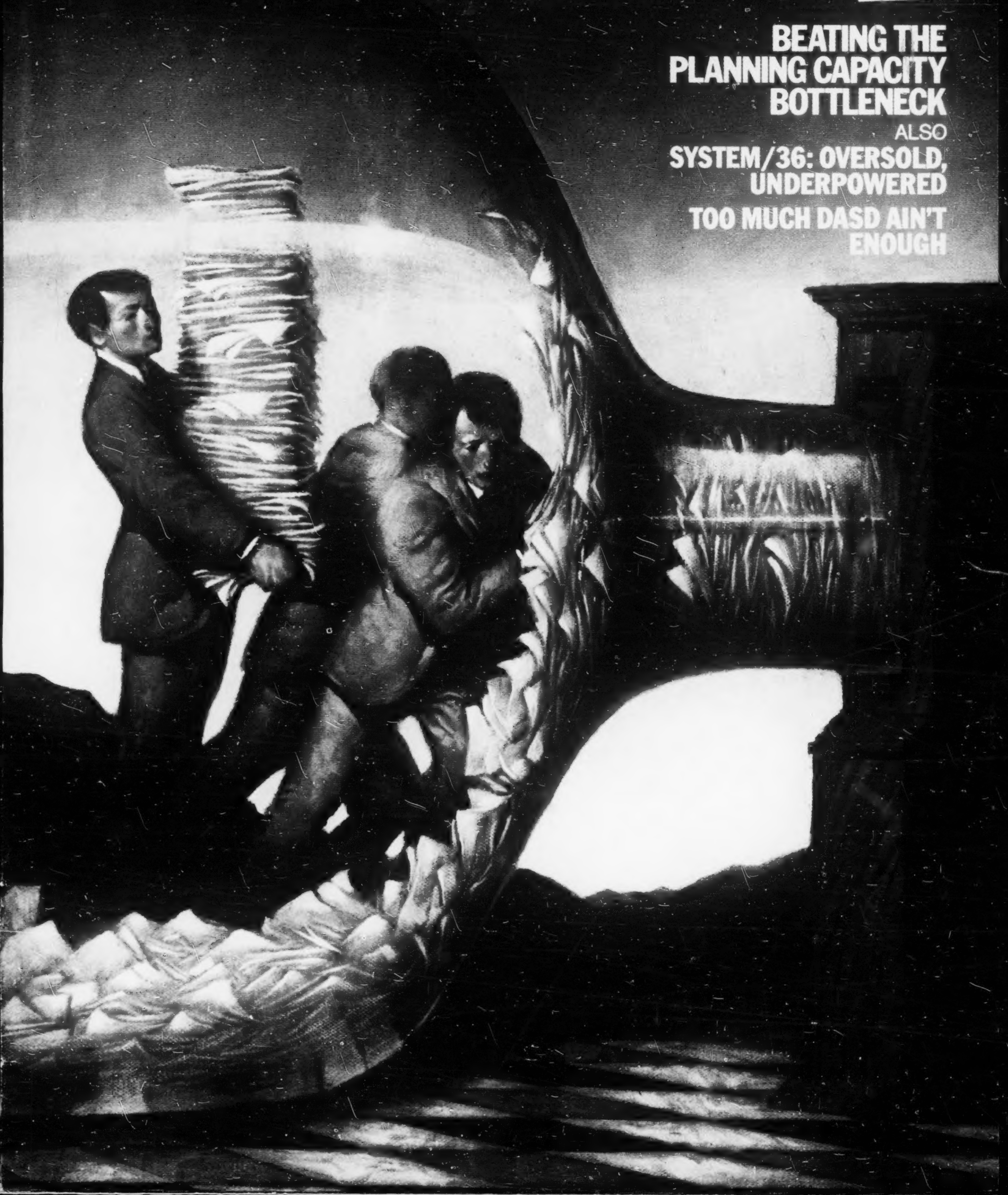
C8050-1A

BEATING THE PLANNING CAPACITY BOTTLENECK

ALSO

SYSTEM/36: OVERSOLD, UNDERPOWERED

TOO MUCH DASD AIN'T ENOUGH



DATAMATION

DECEMBER 15, 1985/$3 U.S.A.
VOLUME 31 NUMBER 24
This issue, 191,368 copies

FEATURES

22
IN FOCUS
For some, proliferating disk drives may be turning out to be too much of a good thing. For others, reports David Stamps, when it comes to DASD, "Too Much Ain't Enough."

53
THE MATURATION OF CAPACITY PLANNING
H. Pat Artis
Communication with senior management is key. Without it, no amount of tools or models can keep hardware purchases in line with corporate needs.

61
HOW THE SOFTWARE WORKBENCH SAVED CHRISTMAS
Richard Harrison, as told to Nicholas Zvegintzov
Or: How the Glitch almost stole Christmas.

67
THE TEMPLATE
Frank Sweet
The "Process-Driven Data Design" series is finally finished with Frank's fitting flourish of a finale: parts 12, 13, and 14.

NEWS IN PERSPECTIVE

30 **MIDRANGE SYSTEMS**
Out of gas.

32 **OPERATING SYSTEMS**
Multi-user DOS?

32 **STRATEGY**
Facelift for Sperry.

37 **FACTORY AUTOMATION**
The force that is MAP.

44 **BENCHMARKS**

48 **WORLDWATCH**

DEPARTMENTS

9 **LOOK AHEAD**
19 **LETTERS**
73 **HARDWARE**
75 **SOFTWARE**
77 **THE MARKETPLACE**
79 **READERS' FORUM**
80 **ADVERTISERS' INDEX**

OEM SUPPLEMENT 48-1

- 3 **BRAND X OR BRAND Y?**

COVER ILLUSTRATION BY DANIEL ADEL

DATAMATION's 1985 survey of microcomputer product preferences

BRAND X OR BRAND Y?

by Edith Holmes

Xerox. Kleenex. Tide. Mercedes-Benz. Brand names all, and among the nation's, if not the world's, most recognizable: an objective that every company hopes to achieve for itself and its products. Companies that sell microcomputer products are no exception.

Each year, DATAMATION assesses the brand preferences that exist within the oem and end-user markets for microcomputers and their peripherals and software. We survey a sample of our end-user and oem readers to give companies a comparative picture of the brand awareness and market acceptance of their products. Reader responses also provide DATAMATION and the industry with a good indication of the directions various microcomputer markets are taking.

As in the past, the 1985 microcomputer brand preferences study does not try to explain a particular company's brand preference score. Instead, readers are invited to draw their own conclusions from the data, evaluating each firm's standing in light of such factors as its acquisitions and mergers, marketing or advertising campaigns, image, technological advances, changes in competitive marketing practices, and overall customer base.

This year's brand preference study involved 5,000 DATAMATION readers, 1,500 of whom worked for oems or vars. Conducted between the end of February and the beginning of April, the survey consisted of a four-page cover letter and questionnaire. Participants were asked to list the three companies they would consider in planning purchases of everything from memory boards to micro-based local area networks, and to list the one company they would prefer if actually buying the product. A prepaid return envelope and a quarter were incentives to reply. In all, some 274 oems and vars, or 18% of those surveyed, responded.

Each company in the study and in this article (see Figs. 1-7) is listed in order according to total awareness mentions (first column) and total preference mentions (second column). Results are given as a percentage of the total number of survey respondents who indicated either awareness of or a preference in a specific product category.

Where there is a tie among awareness mentions, the company with more preference mentions is listed first. Where firms tie in both areas, the listing is alphabetical. In each product category, percentages are given of the participants whose companies use the product today or plan to purchase it in the next 12 months.

The study reports preferences for the oem and end-user markets separately to facilitate comparisons between the two. In every product category, oems and vars deal with a smaller universe of companies than do end users. For example, end users indicated an awareness of some 60 companies supplying 8-bit microcomputers, and 40 of these received preference mentions. Oems and vars listed a total of 41 companies in the awareness column and named 32 of them when indicating preferences.

Beginning with micros themselves, the survey shows a clear preference for Apple Computer Corp.'s 8-bit machines by oem and end-user markets alike. Ranking second with oems and vars with half the mentions is IBM Corp.; number two for end users by a similar margin is Tandy Corp.'s Radio Shack Division, headquartered in Fort Worth. Radio Shack comes in fifth with oems and vars, while IBM is in third place with end users. At the time of the survey, 46.7% of the 435 end users who indicated awareness of and preferences for 8-bit micro vendors and 44.5% of the 157 oems and vars were using these computers. Only 11.9% of the end users and 13.5% of the oems and vars planned to purchase them in the future.

By contrast, 76.6% of 660 end users and 74.8% of 239 oems and vars today employ 16-bit micros, and 51.1% of the end users and 48.5% of the oems and vars expect to buy these machines by early 1986. Hardly surprising is the fact that IBM is far and away the lead vendor in terms of awareness and preference for both markets.

Apple and Compaq Computer Corp. of Houston jockey for second place in the awareness race in both markets, with Apple slightly ahead of Compaq where oems and vars are concerned. Digital Equipment Corp. ranks fourth in awareness in each market, but second in preference among end users and third among oems and vars.

DEC LEADS 32-BIT FIELD

DEC pulls out in front, however, when it comes to the 32-bit supermicros (see Fig. 1). In this category, the company's products are the computers of choice among oems and vars as well as end users. Apple holds second place in awareness for both markets, but ranks just behind IBM in oem and var preference mentions. IBM is listed in third place for awareness in both markets. Relatively small percentages of the 270 end users and 127 oems and vars answering the supermicro preference questions use the machine today (16.9% and 19.0%, respectively), or plan to use them in the future (12.3% and 17.5%).

The percentages are even smaller for briefcase or lap-sized computers—12.8% of 300 end users and 12.4% of 110 oems and vars currently employ these machines; only 8.5% of the end users and 7.7% of the oems and vars expect to buy them anytime soon. Here, Data General takes the lead in awareness and preference among vars and oems. Hewlett-Packard is second, and Radio Shack third. Radio Shack comes out on top in awareness for end users addressing this category, however, but runs behind Data General and Hewlett-Packard in brand preference. Grid Systems Corp. of Mountain View, Calif., is a distant fourth for end users, and fifth—behind Epson America Inc. in Torrance, Calif.—for oems and vars.

Compaq is the preferred vendor for oems, vars, and end users in the last micro-

Brand preferences provide a good indication of the directions many microcomputer markets are taking.

computer category, the transportables. In both markets, IBM and Kaypro Corp. of Delmar, Calif., hold second and third place, respectively. Again, Radio Shack ranks considerably higher with end users (in fourth place) than with oems and vars (in eighth place).

Of the 387 end users and 137 oems and vars responding to the question about transportables, 32.1% of the end users and 27.4% of the oems and vars use these micros now; 15.1% of the end users and 13.5% of the oems and vars expect to purchase them in the months ahead.

Predictably, far more oems and vars use microprocessors or plan to buy them than do end users; 29.2% of the 104 oems and vars responding in this instance employ microprocessors today, compared with 9.8% of 143 end users.

Similarly, 14.6% of the vars and oems will purchase them in the future, against 4.2% of the end users. In both markets, the top two suppliers in this category are Intel Corp. and Motorola (see Fig. 2). While National Semiconductor Corp., Santa Clara, ranks third with oems and vars, IBM comes in third with end users.

In the area of data communications, oems and vars and end users all use and expect to buy many more modems than local area networks, perhaps reflecting the continued immaturity of the latter market. No less than 60.6% of the 546 end users and 57.3% of the 204 oems and vars answering questions about modems currently incorporate them in their micro-based systems, and 28.2% and 25.5%, respectively, will purchase these devices early next year. By contrast, only 15.1% of the 212 end users and 18.2% of the 91 oems and vars addressing LANs on the survey use this hardware today, and just 12.4% and 14.2%, respectively, expect to buy this gear in the near term.

Again predictably, Hayes Microcomputer Products Inc. of Norcross, Ga., and Racal-Vadic of Milpitas, Calif., come in as numbers one and two in modems for both markets. DEC leads the way in awareness of and preference for LAN hardware among oems and vars, followed by IBM, and 3Com Corp. of Mountain View, Calif. (see Fig. 3).

Interestingly, Ungermann-Bass Inc. of Santa Clara, Corvus Systems Inc. of San Jose, Sytek Inc. of Mountain View, and Xerox Corp. virtually tie for fourth place in this market. The corresponding lineup in the end-user market is IBM, 3Com, and DEC. AT&T Information Systems scores relatively low in both markets.

The DATAMATION survey also covers end-user and oem/var preferences for several add-on/add-in devices, such as expansion and memory boards and protocol/terminal emulators, and peripherals, including monitors, printers, plotters, and tape, floppy, and hard disk drives. Highlighted here are two of the most popular product categories, hard disk drives (see Fig. 4) and matrix printers (see Fig. 5).

FIG. 1

OEM MARKET PREFERENCES:

32-BIT MICROCOMPUTERS (SUPERMICROS)

(Percentage Based on 127 Responses)

MANUFACTURER	OVERALL RECOGNITION NO. OF MENTIONS	OVERALL RECOGNITION % OF MENTIONS	BRAND PREFERENCE NO. OF MENTIONS	BRAND PREFERENCE % OF MENTIONS
Digital Equipment Corp.	46	36.2	35	27.6
Apple Computer Corp.	19	15.0	11	8.7
IBM	17	13.4	12	9.4
Motorola Inc.	16	12.6	12	9.4
Hewlett-Packard Co.	12	9.4	8	6.3
AT&T Information Systems	11	8.7	9	7.1
Data General Corp.	10	7.9	3	2.4
NCR Corp.	6	4.7	6	4.7
Apollo Computer Inc.	6	4.7	3	2.4
Sun Microsystems Inc.	6	4.7	3	2.4
Intel Corp.	4	3.1	3	2.4
Prime Computer Inc.	4	3.1	3	2.4
Convergent Technologies Inc.	4	3.1	2	1.6
Plexus Computers Inc.	4	3.1	2	1.6
National Semiconductor	4	3.1	1	.08

All other companies mentioned received less than four mentions each.

FIG. 2

OEM MARKET PREFERENCES:

MICROPROCESSORS

(Percentage Based on 104 Responses)

MANUFACTURER	OVERALL RECOGNITION NO. OF MENTIONS	OVERALL RECOGNITION % OF MENTIONS	BRAND PREFERENCE NO. OF MENTIONS	BRAND PREFERENCE % OF MENTIONS
Intel Corp.	82	78.8	41	39.4
Motorola Inc.	74	71.2	42	40.4
National Semiconductor	18	17.3	3	2.9
Zilog Inc.	15	14.4	1	1.0
Advanced Micro Devices	9	8.7	3	2.9
IBM	7	6.7	5	4.8
Digital Equipment Corp.	5	4.8	4	3.8
Texas Instruments Inc.	3	2.9	0	0
NCR Corp.	2	1.9	1	1.0
National Unlimited Business Systems Inc.	2	1.9	1	1.0
NEC Information Systems	2	1.9	0	0

All other companies mentioned received less than two mentions each.

IBM gets top billing from oems and vars in the hard disk drive category, followed by a near tie between Control Data and Tallgrass Technologies Corp. of Overland Park, Kans. End users gave high awareness and preference marks to IBM,

FIG. 3

OEM MARKET PREFERENCES:

LOCAL AREA NETWORK (HARDWARE)

(Percentage Based on 91 Responses)

MANUFACTURER	OVERALL RECOGNITION NO. OF MENTIONS	OVERALL RECOGNITION % OF MENTIONS	BRAND PREFERENCE NO. OF MENTIONS	BRAND PREFERENCE % OF MENTIONS
Digital Equipment Corp.	21	23.1	15	16.5
IBM	21	23.1	13	14.3
3Com Corp.	18	19.8	9	9.9
Ungermann-Bass Inc.	10	11.0	6	6.6
Corvus Systems Inc.	10	11.0	4	4.4
Sytek Inc.	10	11.0	4	4.4
Xerox Corp.	10	11.0	4	4.4
Wang Laboratories Inc.	5	5.5	4	4.4
Intel Corp.	4	4.4	3	3.3
Apple Computer Corp.	4	4.4	3	3.3
Novell Inc.	4	4.4	3	3.3
Sperry Corp.	3	3.3	3	3.3
Hewlett-Packard Co.	3	3.3	2	2.2
Datapoint Corp.	3	3.3	2	2.2
Orchid Technology Inc.	3	3.3	1	1.1
AT&T Information Systems	3	3.3	1	1.1
NCR Corp.	2	2.2	2	2.2
Nestar Systems Inc.	2	2.2	1	1.1
AST Research Inc.	2	2.2	1	1.1

All other companies mentioned received less than two mentions each.

FIG. 4

OEM MARKET PREFERENCES:

HARD DISK DRIVES

(Percentage Based on 132 Responses)

MANUFACTURER	OVERALL RECOGNITION NO. OF MENTIONS	OVERALL RECOGNITION % OF MENTIONS	BRAND PREFERENCE NO. OF MENTIONS	BRAND PREFERENCE % OF MENTIONS
IBM	36	27.3	28	21.2
Control Data Corp.	22	16.7	15	11.4
Tallgrass Technologies Corp.	22	16.7	13	9.8
Shugart Corp.	12	9.1	6	4.5
Tandon Corp.	11	8.3	5	3.8
Seagate Technology	11	8.3	2	1.5
Digital Equipment Corp.	10	7.6	5	3.8
Iomega Corp.	7	5.3	7	5.3
Corvus Systems Inc.	6	4.5	2	1.5
Hewlett-Packard Co.	5	3.8	5	3.8
Micropolis Corp.	5	3.8	4	3.0
Fujitsu America Inc.	5	3.8	4	3.0
Mountain Computer Inc.	5	3.8	4	3.0
Qubie Distributing	4	3.0	4	3.0
Alloy Computer Products Inc.	4	3.0	4	3.0
Sperry Corp.	4	3.0	2	1.5
Tecmar Inc.	4	3.0	0	0
Maxtor Corp.	3	2.3	1	0.8

All other companies mentioned received less than three mentions each.

Tallgrass, and DEC. Of the 309 end users answering survey questions about hard disk drives, 29.6% said they use these devices and 14.4% plan to buy them. Correspondingly, 34.7% of 132 vars and oems currently employ hard disk drives in their systems, and 14.2% expect to purchase them next year.

EPSON PRINTERS LEAD LIST

Matrix printers made by Epson America lead the awareness and preference lists for end users and oems and vars, alike. Okidata Corp. in Mt. Laurel, N.J., holds a strong second place in both markets. Though IBM is slightly ahead in awareness of NEC Information Systems of Boxborough, Mass., Hewlett-Packard, and C. Itoh Electronics Inc. of Los Angeles, NEC and DEC rate higher in terms of brand preference among oems and vars. Barely trailing IBM in this regard are Centronics Data Computer Corp. in Hudson, N.H., Hewlett-Packard, C. Itoh, and Texas Instruments Inc. The survey shows that matrix printers are a part of many micro-based systems. Of the 595 end users responding to questions about this product category, 69.3% use matrix printers today, and 29.9% will buy them within the year. Similarly, 59.1% of the 197 oems and vars answering these points employ such printers, and 25.5% say they will do so in the future.

The survey covered software as well as hardware, including database management systems, operating systems, spreadsheet packages, word processing programs, language processors, and electronic mail. In both the oem and end-user markets, Culver City, Calif.-based Ashton-Tate's products lead the brand preference parade for database management systems; Microsoft Corp. of Bellevue, Wash., holds a narrow lead over IBM in operating systems; Lotus Development Corp. in Cambridge, Mass., is tops in spreadsheet packages and multifunction integrated software; and MicroPro International Corp. of San Rafael, Calif., continues to hang on to first place in word processing programs.

Interestingly, Microstuf Inc., based in Roswell, Ga., is number one in awareness and preference for communications software among end users, and first in awareness and second in preference among oems and vars (see Fig. 6). Second on both market lists is Hayes Microcomputer Products, which is at the top of the brand preference list for oems and vars. IBM comes in third for end users and oems and vars in both categories.

Of the 113 oems and vars answering the communications software questions, 33.9% use these programs today, and 10.6% expect to do so in the future. For the 317 end users answering this portion of the survey, 34.8% employ these programs, and 14.6% plan to buy them by next year.

Even fewer end users, oems, and vars use or plan to purchase micro-to-mainframe software, according to the survey. Of the 201 end users who responded to questions in this product category, only 18.1% use this software today, and just 10.6% expect to buy it. The corresponding numbers for the 54 participating oems and vars are 11.3% and 7.7%. Further, only

And Now, the Poster!

DATAMATION
SO, HOW ARE YOUR COMPANY'S PC USERS GETTING ALONG?
IT'S NEVER DONE THAT BEFORE

DATAMATION
ON-SITE TELECOM BLOSSOMS
ALSO
PORTS IN THE UNIX STORM
ASSURING QUALITY QUALITY ASSURANCE
HANDICAPPING CAN PLANS

Ten dollars buys an 18-inch by 24-inch, four-color reproduction of our June 15 cover. This exploded pc generated so many letters we just had to do it! Also available: a poster version of our March 1 "wire blossoms" cover.

To order, send a check ($10 per poster) made out to DATAMATION, with your name and address, to DATAMATION Poster, 875 Third Ave., New York, NY 10022. Please specify "June 15 Exploded Pc" or "March 1 Wire Blossoms."

DATAMATION

FIG. 5

OEM MARKET PREFERENCES:
MATRIX PRINTERS
(Percentage Based on 197 Responses)

MANUFACTURER	OVERALL RECOGNITION NO. OF MENTIONS	OVERALL RECOGNITION % OF MENTIONS	BRAND PREFERENCE NO. OF MENTIONS	BRAND PREFERENCE % OF MENTIONS
Epson America Inc.	120	60.9	72	36.5
Okidata Corp.	59	29.9	34	17.3
IBM	19	9.6	8	4.1
NEC Information Systems	18	9.1	12	6.1
Hewlett-Packard Co.	18	9.1	6	3.0
C. Itoh Electronics Inc.	17	8.6	6	3.0
Digital Equipment Corp.	16	8.1	10	5.1
Centronics Data Computer Corp.	15	7.6	7	3.6
Star Micronics Inc.	14	7.1	5	2.5
Texas Instruments Inc.	11	5.6	6	3.0
Apple Computer Corp.	7	3.6	3	1.5
Printronix Inc.	6	3.0	5	2.5
Genicom Corp.	6	3.0	4	2.0
Mannesmann Tally	6	3.0	2	1.0
Dataproducts Corp.	6	3.0	2	1.0
Toshiba America Inc.	5	2.5	0	0
Panasonic Consumer Products	4	2.0	2	1.0
Anadex Inc.	4	2.0	2	1.0
Integral Data Systems Inc.	3	1.5	1	0.5
Diablo Systems Inc. Div., Xerox Corp.	3	1.5	1	0.5

All other companies mentioned received less than three mentions each.

FIG. 6

OEM MARKET PREFERENCES:
COMMUNICATIONS SOFTWARE
(Percentage Based on 113 Responses)

MANUFACTURER	OVERALL RECOGNITION NO. OF MENTIONS	OVERALL RECOGNITION % OF MENTIONS	BRAND PREFERENCE NO. OF MENTIONS	BRAND PREFERENCE % OF MENTIONS
Microstuf Inc.	31	27.4	21	18.6
Hayes Microcomputer Products Inc.	27	23.9	23	20.4
IBM	20	17.7	13	11.5
Headlands Press Inc.	10	8.8	7	6.2
Digital Equipment Corp.	6	5.3	5	4.4
Hewlett-Packard Co.	4	3.5	4	3.5
AST Research Inc.	4	3.5	4	3.5
Mycroft Labs Inc.	4	3.5	3	2.7

All other companies mentioned received less than four mentions each.

five companies received enough awareness and preference mentions from the oems and vars to make the survey. They are, in order of appearance, IBM, DEC, Digital Communications Associates Inc. of Norcross, Ga., AST Research Inc. in Irvine, Calif., and Cullinet Software Inc. of Westwood, Mass. The list of micro-to-mainframe linkage software also includes the Kermit program, which is in the public domain. ◉

The complete study is available for $100 from the Market Research Department, Technical Publishing Co., 875 Third Ave., New York, NY 10022. ◉

Reprints of all DATAMATION articles, including those printed in 1984, are available in quantities of 100 or more. Details may be obtained by telephoning Donald Reid, (212) 605-9470.

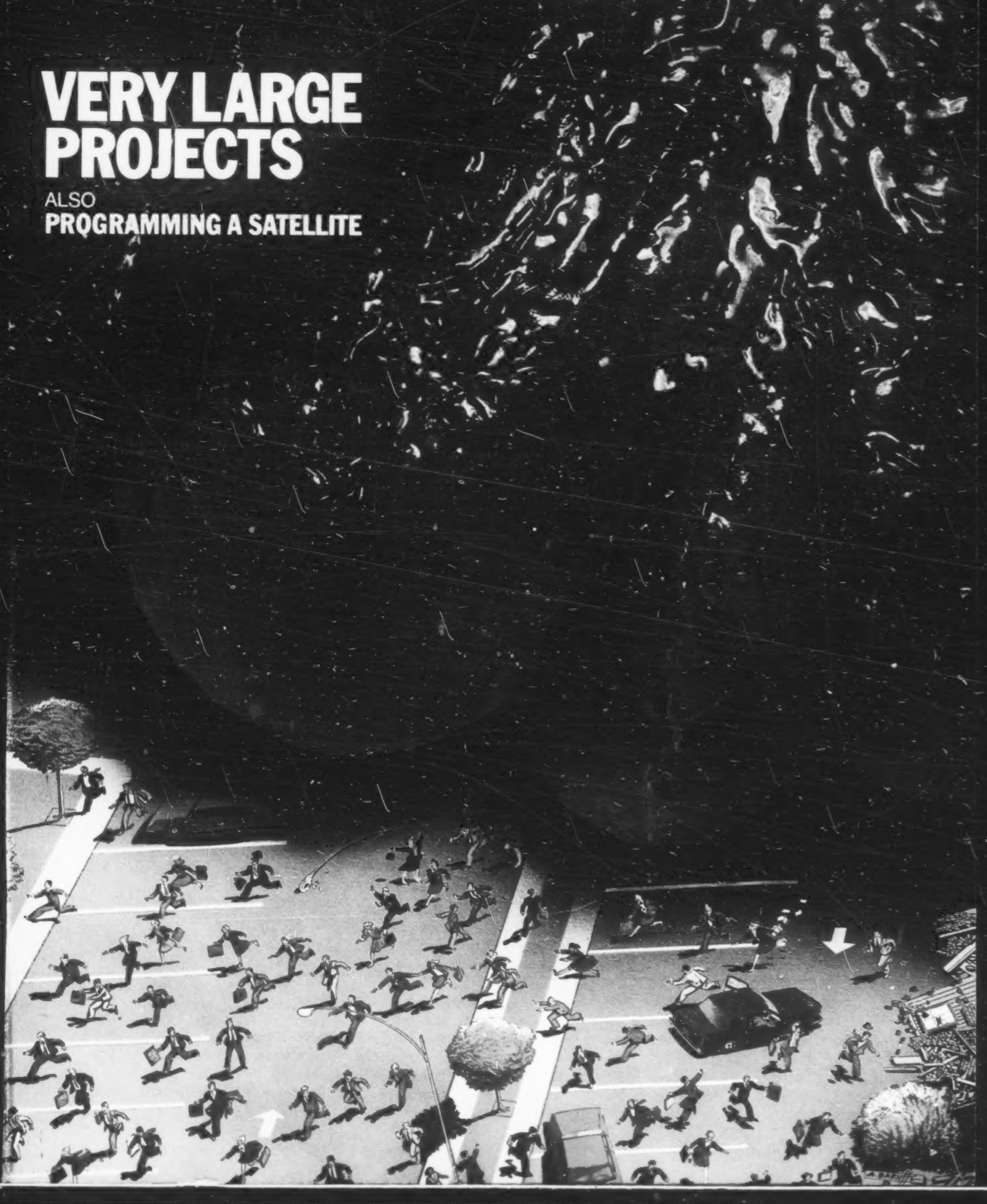
1/24/86
C8650-A

DATAMATION 86
OEM EDITION JANUARY 15 $3 © TECHNICAL PUBLISHING

VERY LARGE PROJECTS

ALSO

PROGRAMMING A SATELLITE



DATAMATION

JANUARY 15, 1986/$3 U.S.A.
VOLUME 32 NUMBER 2
This issue, 191,831 copies

FEATURES

62
VERY LARGE PROJECTS
Daniel S. Appleton
Some systems are too big to be designed using top-down decomposition and implemented using bottom-up structured program modules, and will not move, as a whole, from development into maintenance. So what do you do with them?

75
THE RIGHT STUFF
Joel S. Zimmerman
The successful development of a complicated software system may hinge on learning from previous successes. The development of this NASA satellite software system is a prime example.

85
BOEING'S PC PRACTICES
Richard Metz
Faced with administering five major data centers, more than 5,400 micros, hundreds of minis, in addition to 40,000 software packages, the company has promulgated corporate information systems standards that are intended to bring a focused, integrated approach to its computing activities.

91
NLP TAKES OFF
Tim Johnson
All signs point to the fact that natural language processing is gaining speed as a commercial computing technology.

NEWS IN PERSPECTIVE

26 **TAXATION**
The next step.

28 **RESEARCH**
Doing it at home.

28 **TECHNOLOGIES**
A natural fit?

30 **COMMUNICATIONS**
Airing the issues.

38 **LEGAL AFFAIRS**
When dp needs a lawyer.

45 **COMPUTERS**
Making a dent.

50 **DISK DRIVES**
Testing the waters.

54 **BENCHMARKS**
56 **WORLDWATCH**

DEPARTMENTS

9 **LOOK AHEAD**
14 **CALENDAR**
19 **LETTERS**
23 **HARDCOPY**
95 **HARDWARE**
99 **SOFTWARE**
104 **ADVERTISERS' INDEX**
105 **READERS' FORUM**
107 **SUBJECT INDEX**

OEM SUPPLEMENT 60-1

-3 **INSURING THE FIT**

COVER PHOTOGRAPH BY TOGASHI.
SCULPTURE BY NICK ARISTOVULOS.
ILLUSTRATION BY ANDREA BARUFFI

Natural language processing has been more dreamed about than realized, but the optimistic talk is beginning to prove true.

NLP TAKES OFF

by Tim Johnson

After years of looking as though it might never leave the runway, natural language processing is approaching takeoff as a commercial computing technology. The signs are multiplying: the research people are demonstrating new solutions to some old problems; new ventures and new products are bringing these solutions to market; and sales of the products already available are starting to increase. These preliminary successes are stimulating more spending on R&D—and providing the positive feedback that may finally get the whole show off the ground.

What is natural language processing, anyway? Briefly, it is building computer systems to understand English—or any other "natural language"—as it is spoken or written by real people. This means building systems that are able to analyze a string of words to identify its meaningful components and the relationship between them—what the grammarians call parsing.

Parsing is the essential feature of a natural language processing (NLP) system, and systems that do not parse ordinary language are not NLP. This excludes voice recognition systems, which recognize single words or phrases and map them directly onto computer commands. It also excludes "English-like" fourth generation languages: even though individual words may look familiar, they have to obey a formal computer grammar that is not at all that of ordinary language.

Why should computers need to parse natural language? Either because people want to communicate with the machine, or because the machine can help people to communicate with one another. If managers want easy communication with corporate databases on mainframes, NLP can provide a natural language database interface. If a company wants its technical manuals to be read by German (or French, or Spanish, or Japanese) speakers, an NLP machine system can help translate them more quickly.

Many NLP researchers believe their technology will come into its own only with the advent of the "talkwriter"—the machine that converts spoken dictation into written text or database commands. The talkwriter is much closer to realization now than seemed possible a year or two ago.

IBM has already demonstrated a research system with impressive performance. Kurzweil Applied Intelligence of Waltham, Mass., a small startup backed by Xerox and Wang, is proposing to install the first demonstration/evaluation test units of its own talkwriter any month now. The machine is supposed to have a vocabulary of 10,000 words. That would indeed be an impressive and exciting achievement, perhaps even the beginning of a new era in the use of computers. But no one should expect those first test samples to lead quickly to robust operational products. If there is one lesson to be learned from the past history of NLP developments, it is that bringing them up to commercially acceptable levels of performance is a long, slow process.

The two areas where NLP products have gone through this process and achieved commercial acceptance already are mainframe interfaces and machine translation. It took the pioneer of NLP interfaces, Artificial Intelligence Corp. (AIC), also of Waltham, a full six years of development before the first commercial installation of its Intellect system was accepted in 1981. Machine translation systems have been around for even longer, but until very recently they ran only on large mainframes to serve customers with huge translation needs—customers such as the Air Force and the Commission of the European Common Market.

In 1983, IBM broke all precedents by signing an agreement with AIC to sell the Intellect system. Since then, Mathematica Products Group in Princeton, N.J. (part of Martin Marietta Data Systems), has come out with an NLP interface for its Ramis II

Explain
Listen
Talk
Obey
Write
Understand
Speak
Parse
Tell
Say

CALLIGRAPHY BY RAY BARBER

No one should expect those first test samples to lead quickly to robust operational products.

DBMS. Information Builders Inc., New York, has countered with a version of Intellect that is integrated with its Focus DBMS—Ramis II's biggest competitor. Other companies jumping into the business are Microdata, Irvine, Calif. (part of McDonnell Douglas), and Frey Associates, Amherst, N.H.

SIGNS ARE GOOD

The competition may have done AIC more good than harm. The company shows signs of brightening up its uninspired marketing approach and it reports an increased rate of sales, from a rather steady 70 installations a year to twice that between mid-1984 and mid-1985. Perhaps more important, it can point to a growing number of customers who have learned to use and rely on Intellect, and who can demonstrate some real added value as a result.

Take PPG Industries, for example. Formerly Pittsburgh Plate Glass, this giant with 37,000 employees has its headquarters in a glass-clad Gothic skyscraper in Pittsburgh's Golden Triangle. Since 1983, it has been using Intellect to ease marketing, order processing, and stock control inquiries for the group that handles its fiberglass products. By 1985, Intellect was handling an estimated 300 to 500 inquiries a day, generated both by headquarters staff and by 35 on-the-road salesmen who communicate through portable terminals.

Tim Schell, supervisor of sales and marketing systems, who chose the system and was responsible for getting people to use it—this technology still needs an internal champion—estimates that processing inquiries are between 50 cents and $20 in allocated computer costs. They range from the routine check on the latest sales figures to quite complex impromptu requests. The day before I visited PPG's operation, two staff members had wanted to know what orders had been placed with a certain factory for each week in the month ahead, in order to head off a threatened overstocking problem. "It took two questions and about five minutes through Intellect to come up with data which would have taken hours by any other route," reported one satisfied user.

Machine translation (MT) is following a parallel line of development. Here, while the older established suppliers have stayed with mainframe systems, a new generation of companies has started to offer machine translation systems that run on office minis, or even big micros. Logos, also of Waltham, originally developed its MT skills translating helicopter maintenance manuals during the Vietnam war. It has a German-to-English system that runs on the Wang Office Information System. ALPS (Automated Language Processing Systems) of Provo, Utah, and Weidner of Northbrook, Ill., both grew from the translation efforts of the Mormon Church, and currently offer systems running on a Data General mini and an enhanced IBM PC XT, respectively. Even though they all originated in the U.S., these companies have discovered that the big market for translation is in Europe, especially the in-house translation departments of major electronics and computer companies.

MT SEEMS TO BE A WINNER

There is growing evidence that MT can double the productivity of translators, providing a reasonable first draft of a technical manual for a human translator to correct and polish. MT can also improve quality in some respects, such as consistency of vocabulary. When Veronica Lawson, a leading translation consultant, visited Logos users in the early days of its German-to-English MT system, she found them reporting anything from 20% to 140% gains in productivity. ITT Europe claims "a two- to fourfold increase in output per translator" with its Weidner MT system. ALPS quotes Texas Instruments as saying that after one month of usage, two ALPS terminals had brought down the total costs of handling translations to $25 a page from $55.

As the evidence of success grows, more new products are appearing. There are one or two products offering micro versions of database interfaces; Clout, from Microrim of Bellevue, Wash., is the best known and there are others on the way. But the pc's power in the natural language arena is thus far strictly limited by memory and processing power.

Texas Instruments has a different approach, one that gives the user all the grammatical constructions that the underlying application is able to deal with, but expresses them in preselected words. Using this product, called NaturalLink, the user builds up a query sentence from an "intelligent menu" of words and phrases. The "boilerplate" menu changes dynamically, to show the user all the options available, and it can readily be translated into any language chosen by the system developers. This approach may well prove the best way of providing natural language on micros, at least until they become many times more powerful than they are today.

At the other end of the computing scale, natural language interfaces to mainframes are the subject of major research programs now beginning to bear fruit. SRI International, the nonprofit research center based in Palo Alto, recently completed its Team database interface, funded by DARPA at a cost of over $1.5 million. Compared with existing commercial NLP interfaces, Team will offer wider linguistic coverage, easier portability, greater independence of the underlying database structure, and new facilities for acquiring linguistic knowledge from nonspecialists. Team will be offered on license to universities and research labs, but it will not be turned into a commercial product.

On the other side of the continent, however, BBN, the Boston-based systems house, has announced it will sell a version of its Irus NL interface in 1986. Like SRI, BBN has had major DOD and DARPA contracts for NLP development for many years. Irus shares many of the origins of Team, and will be brought to market with the help of a $5.3 million R&D partnership with Pru-Tech Research and Development of London. Products like Irus should be able to raise the performance of NLP interfaces to a new level; but no one should underestimate the time and effort required to get new natural language products into successful operation in the commercial environment. So far, the six years it took to get Artificial Intelligence's Intellect to market seems the rule rather than the exception.

The other major research objective in this area is the development of dialog interfaces—systems that can support something akin to a two-way conversation with the user, rather than simply responding to individual commands. This type of interface will need to maintain an internal model of the user's objectives and state of mind as the conversation proceeds, something we do unconsciously in human conversation. The artificial intelligence community sees dialog interfaces as an essential for future user-friendly interfaces with expert systems, or for such applications as intelligent computer-aided instruction.

A significant project combining talkwriter-like speech recognition and user modeling to interface to an expert system is Vodis, backed by the government-funded Alvey Program in the U.K. Vodis is intended to provide an automated system for answering telephone inquiries in a limited domain—initially train timetables. It is being developed by British Telecom and a team led by Steve Young, a lecturer in the electrical engineering department at Cambridge University, at a cost of $2.8 million by 1988.

While NL database interfaces and machine translation products have been around for some time, other NLP applications are only now appearing or are still in

FIG. 1

PROJECTED SALES OF NLP APPLICATIONS IN THE U.S. ($ MILLIONS)

APPLICATION	1985	1990	1995
Mainframe interfaces	9	59	184
Micro interfaces	3	120	250
Dialog interfaces	0	8	103
Content scanning	1	45	94
Text editing	0	38	295
Machine translation	2	53	84
Talkwriters	0	95	457
TOTALS	**15**	**418**	**1,467**

Note: Talkwriter projections include dedicated hardware; other figures are for software and support only.

Source: Ovum

the future. The one that looks like the best prospect for an early return has been dubbed content scanning. This means using an NLP system to scan through messages and map them onto a standard format, so they can be loaded to a database or routed to the right person.

Much of the research in this area has been done for the U.S. Navy on hardcopy, ship-to-shore messages relating to equipment faults or enemy contacts. But the most promising commercial application is for processing international money transfer messages for banks.

Several companies are known to be working on content scanning for banks. The first one to announce a product is Cognitive Systems of New Haven. Cognitive's Atrans needs to know a large number of banks by their nicknames; it has to be able to take a telex in French and reformat it in English; it must understand which five-figure number is a security code, which a date, and which a sum of money.

TEXT EDITING PRODUCTS

Products are also expected to appear soon for another application, text editing. This is the use of NLP capability to monitor and correct the style and grammar of written English, as in business letters and other company documents. It could be seen as the natural next step after word processing spelling correctors. IBM's Yorktown Heights, N.Y., laboratory has developed a text editor (they prefer to call it a text critiquer) called Epistle, which is on field test within the company and at a graduate school. The main obstacle to a product launch is probably economics rather than performance; Epistle runs on a mainframe under VM, which would break most people's word processing budgets.

All these applications—interfacing, machine translation, content scanning, text editing—can operate on natural language entered at a keyboard, or already available from a word processor. Clearly, their value would be much increased if they could accept continuous speech as well, which is why so many research teams around the world are racing to produce the first effective talkwriter.

Besides IBM and Kurzweil, already mentioned, another startup, Speech Systems of Tarzana, Calif., has promised to deliver its first sample products before the end of 1986. DARPA is funding research projects at MIT and Carnegie-Mellon University; the British government's Alvey Program is backing a project led by Britain-based Plessey and Edinburgh University; there are at least two projects under way in the big Japanese laboratories at NEC and NTT.

The competing teams will have to combine the very highest skills in signal processing, electronic design, mathematics, acoustics, and human factors, as well as NLP. And it appears that the integrated solution to all these problems is now being rapidly approached.

Yet some forecasts for the short-term sales of talkwriters are entirely too optimistic. At this moment, nobody in the world knows how talkwriters will be used in real offices. It is bound to take several years to solve these problems in ways that will be acceptable to large numbers of users. Once that has been done, the talkwriter will become a very significant product, as indicated in Fig. 1.

NLP SALES SHOULD GROW

The figure shows projections for sales of talkwriters and the other NLP applications discussed here, as prepared for Ovum, a U.K. consultancy specializing in market and technology forecasting in the field of artificial intelligence and advanced digital communications. They must be treated with caution—there is simply not enough information available to produce proper forecasts yet. But they reflect Ovum's view of the relative importance of the different applications, and the possible time scale of their development. They look forward to a time 10 years hence—it is unlikely to be sooner, it could take longer—when the talkwriter will increasingly be seen as the keystone of integrated networks of NLP applications, at least in the larger and more advanced organizations.

Imagine, then, the business environment of the 21st century, when every ambitious multinational has its own corporate language system. Microphones are carefully placed wherever there is an information-gathering requirement: in executive workstations, at conference tables, with the order clerks. Speech is transcribed into text or computer commands. Text editing suggests grammatical corrections and ways to tighten up loose style. Where required, documents are routed on for machine translation, and out across electronic mail networks. Content scanning decides how to index each new document, and how to route incoming messages. Company executives and, where appropriate, outside customers and suppliers, can interrogate the company's databases and other information resources directly. An interlinked hierarchy of lexicons maintains consistency in the corporate use of language, and authorized trade names and new usages are propagated automatically through the system.

An Orwellian vision? Technically impossible? An uneconomic white elephant? Time will tell. To talk of integrating NLP applications when they are barely beginning to prove themselves on a stand-alone basis may seem premature. But the logic is strong. Development of each application will be a lengthy and expensive business. In each case, much of the effort will go into building up vocabularies and defining semantic relationships. Although each individual application will cover a limited domain, there will be extensive overlap between them. Unless they are harmonized and coordinated, chaos may well result.

So, will "language servers" be just one of the standard facilities on the local area networks of the future? Or will the richness and variety of human language—and the thoughts and feelings it tries to express—prove too elusive for computer technology? There will always be a depth and meaning in human communication that will be beyond the power of any computer to follow. But it is a fair bet that where the talk is of stock levels, sales figures, and letters of credit, the computer will more than hold its own.

Never mind the paperless office; in another 30 years, will it be the peopleless office? ◉

Tim Johnson of Ovum Ltd. specializes in the commercial applications of AI technology. He lives in London and has worked as a principal consultant with Logica and for the London *Sunday Times*.

C8650-1A

DATAMATION

86
INTERNATIONAL EDITION APRIL 1 $3 ©TECHNICAL PUBLISHING

WILL IT FLY? BETA SITE REALITIES

ALSO:

1986 DP BUDGET SURVEY
IBM TIPTOES INTO INDIA
DATABASE MACHINES

DATAMATION

APRIL 1, 1986/$3 U.S.A.
VOLUME 32 NUMBER 7
This issue, 193,330 copies

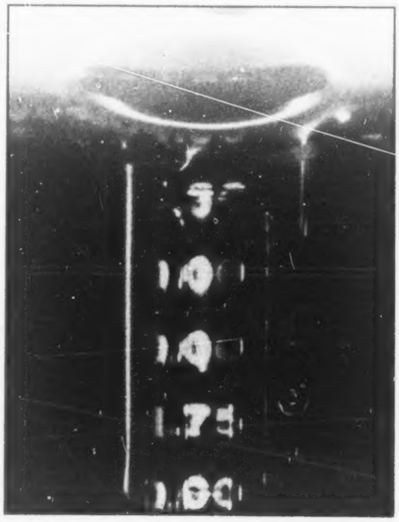
FEATURES

54
BIG BLUE TIPTOES INTO INDIA
Maggie McLening

IBM abandoned the South Asian market in a fit of pique seven years ago. Now, the Indians are watching their feet as the computer behemoth returns.

62
BETA SITE POLITICS
David Stamps

Vendors want real-world labs for testing new products. Dp managers want to get their hands on new technologies early and get the extra support. Getting them together is the interesting part.



74
1986 DP BUDGET SURVEY
John W. Verity

A random sampling of dp budgets from some 600 U.S. sites shows an average increase over 1985 of only 4.2%. This and other findings within.

83
RELATING TO DATABASE MACHINES
Lee Sigler

While the market is still small, increasing numbers of systems developers have been buying them to store and retrieve information on such encyclopedic subjects as money, people, construction materials, and art.

93
THE TROUBLE WITH APPLICATION GENERATORS
Bob Stahl

Application generators—those labor-saving software programs—shorten development time, but don't, by themselves, produce successful systems.

97
EDP TODAY

The Industry's Newspaper. Computer McPaper. All the News That Fits We Print. You get the idea.

NEWS IN PERSPECTIVE

22 **COMMUNICATIONS**
Getting in sync.

24 **STANDARDS**
A bridge too far.

33 **STRATEGIES**
Who's zoomin' who?

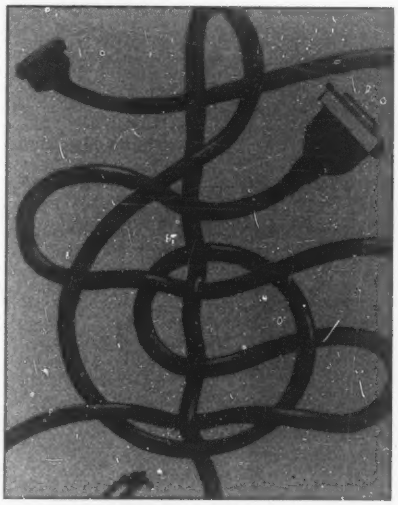
36 **SOFTWARE**
Castles in the air.

41 **OPERATING SYSTEMS**
Call it living together.

44 **BENCHMARKS**

DEPARTMENTS

9 **LOOK AHEAD**
15 **LETTERS**
19 **EDITORIAL**



70 **MARKETPLACE**
101 **PEOPLE**
105 **HARDWARE**
111 **SOFTWARE**
115 **READERS' FORUM**
116 **ADVERTISERS' INDEX**

SPECIAL REPORT 52-A

COMPUTERIZED PUBLISHING TECHNOLOGY

INTERNATIONAL 52-1

- 1 **A SLOW PASSAGE TO INDIA**
- 9 **THE WEST GERMAN WAY**

COVER PHOTOGRAPHS: TOP AND CENTER, COURTESY NATIONAL AIR AND SPACE MUSEUM, SMITHSONIAN INSTITUTION; BOTTOM, BETTMAN ARCHIVES.

Japan's dp business with the Asian nation may finally be picking up steam.

A SLOW PASSAGE TO INDIA

by Thomas Murtha

Frustrated by bureaucratic red tape and severe business restrictions, Japanese vendors have been reluctant to take their dp wares India. But now that some of those hurdles have been removed, Japanese dp business with the South Asian subcontinent could pick up substantially.

"The Japanese presence in the Indian computer market has been minimal because we haven't found conditions appropriate for establishing or expanding production capacity in India," explains Masafumi Misu, an advisor to Hitachi's board of directors. "Hitachi has been approached by Indian entrepreneurs in the computer business. Some of them were former IBM employees. We negotiated, but as with every deal in India, the government was very involved and moved slowly.

"The Indian intention seemed to be to negotiate with many competitors in an effort to get the best deal," says Misu, who is also vice chairman of the Japan Machinery Exporters' Association. "Such an attitude discouraged us because it became very difficult to have confidence in a potential partner. They also wanted us to have full responsibility for the performance of a company in which we have no capital investment. We weren't enthusiastic about dealing with Indian business in this way. That was several years ago. Now the situation appears to be changing."

The Indian government claims that its recent efforts to promote the nation's dp sector provide new opportunities for foreign participation. Prime Minister Rajiv Gandhi's visit to Japan last November is also an encouraging sign for that country.

Following the first significant reduction of computer import restrictions in 1983, India continued to loosen controls. Last year, most of the old licensing policies were liberalized to emphasize promotion rather than regulation of the computer industry. The remaining restrictions, however, still effectively lock up the industry for locals. Outside ownership of local dp manufacturing operations, for example, is not allowed to exceed 40%, and stiff import duties protect dp wares manufactured in India from cheaper foreign competition.

The situation was even worse for foreign firms two to three years ago. Japanese vendors in particular have had an uphill battle trying to sell large-scale systems in India. The notable exception here was NEC, which successfully bid four ACOS series computers in 1984 for India's National Informatics Center Network (NICnet). One year later, when the Indian government chose to import technology for production of 1MIPS mainframes, no Japanese company even submitted a proposal. Competition soon narrowed down to Bull of France and Control Data, which ended up winning the $500 million contract in February.

Although Japanese computer sales to India are still small, there has been a sharp surge in exports under the more liberal policies of Rajiv Gandhi's administration. Japanese sales of dp hardware to India more than tripled in 1985, reaching a record high of $17.8 million. Telecom exports also grew a hefty 36.5% in 1985 to $62.8 million.

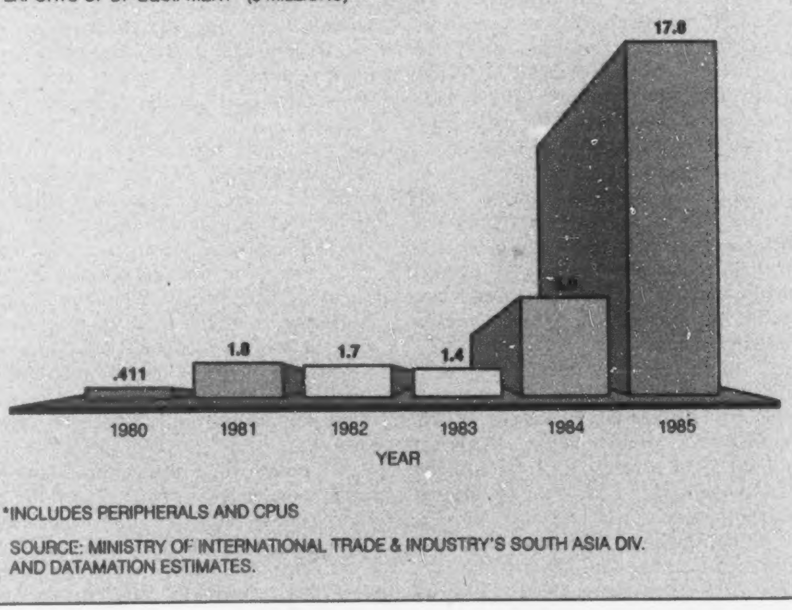
This brighter export picture is a reflection of India's increasing willingness to do dp business with outsiders. "Following the liberalization of our policies in 1984 and 1985, we explained the changes to Japan and other nations with technological expertise," points out Paratha Das, counselor for science and technology at the Indian embassy in Tokyo. "We requested that [the Japanese] develop their strategies for cooperation with India in light of these changes. So far we have not received final responses from Japanese corporations. It seems they are taking the time necessary to understand our position and to formulate their own. This is the normal Japanese way of doing business.

"The Japanese don't appear as ag-

FIG. 1

JAPAN'S DP EXPORTS TO INDIA

EXPORTS OF DP EQUIPMENT* ($ MILLIONS)



*INCLUDES PERIPHERALS AND CPUS

SOURCE: MINISTRY OF INTERNATIONAL TRADE & INDUSTRY'S SOUTH ASIA DIV. AND DATAMATION ESTIMATES.

gressive as their counterparts in America and Europe," contends Das. "They are more cautious. We understand the necessity of careful evaluation before making a commitment. But we eventually hope to reach some agreements for technology exchanges with the Japanese."

ANXIOUS TO INK DP PACTS

The Japanese, worried that their high-tech rivals have gotten the jump on them in this emerging market, are also anxious to ink dp pacts with the Indians. "Europe and America are our main competitors in foreign markets," observes Yasuo Fujimoto, a South Asia specialist for international trade policy with Japan's Ministry of International Trade & Industry (MITI). "Their computer firms, especially America's, are rushing to India after Rajiv Gandhi called for liberalizing the import of high tech. If Japanese firms don't act now," he warns, "the Indian computer market will be sewn up by the Americans and Europeans."

Last year, India signed technology exchange agreements with both the U.S. and Japan. That should make business life in India better for the Japanese as long as they play by the rules established by the Coordinating Committee for Multilateral Export Controls (Cocom).

"Since India is not an Eastern Bloc nation, there aren't any direct restrictions on technology transfer from Japan," explains Michio Hamano, the deputy director of MITI's export security control office. "However, we do have to be careful to ensure that computer and other high-tech exports to India are not diverted to the Soviets. With mainframe computer installations in India, for example, we're concerned about Soviet technicians having access. The Americans are very anxious about this at present and we make every effort to respect these concerns in our approval of export licenses."

Japanese firms have had an easier time in India peddling telecom products, since these wares have fewer Cocom controls. There's also less reason for concern because India has agreed that end-user sites can be inspected for imported computer and telecom gear.

"Japanese government policy is often affected by U.S. policy," according to Tadaharu Kobayashi, manager of the Southwest Asia division at NEC. "Although we have to be careful about exporting to India in general, in the field of telecommunications we expect fewer problems."

The Japanese have been careful in all of their dealings with the Indian nation. "Of course we're cautious about investing in India and transferring technology," says one Japanese trade official. "Indian technocrats and industrialists claim to be able to produce anything if they are provided with the technology. But many Japanese are skeptical about such claims."

The trade official goes on to complain about the bureaucratic and business procedures that can bog down a company. "The simple fact is that most industry in India is not in the hands of the private sector. In New Delhi, 70% of the total work force is directly or indirectly part of the government bureaucracy. And where there is that big a bureaucracy, someone is always asking for baksheesh to get something done. Japanese don't like to do business when the electrical supply and telephone service may depend on a bribe."

There is, however, some optimism at the end of the Japanese offical's diatribe. There's also a familiar bottom line. "Maybe the Indian computer industry can become more streamlined and efficient. Japanese business is willing to help develop the industrial infrastructure, but only if there's a reasonable chance for a return on investment."

India, which wants those same returns, is hedging its high-tech bets by not putting all its chips on any one country. "The Indians clearly want Japanese computer firms to invest in their country," declares MITI's Fujimoto. "One of the reasons is that they want the best production technology available. But at the same time, they don't seem to want to rely too much on Japan for training and basic technology. It could also be because of linguistic differences as well as the perception that America is more advanced in strategic areas like software."

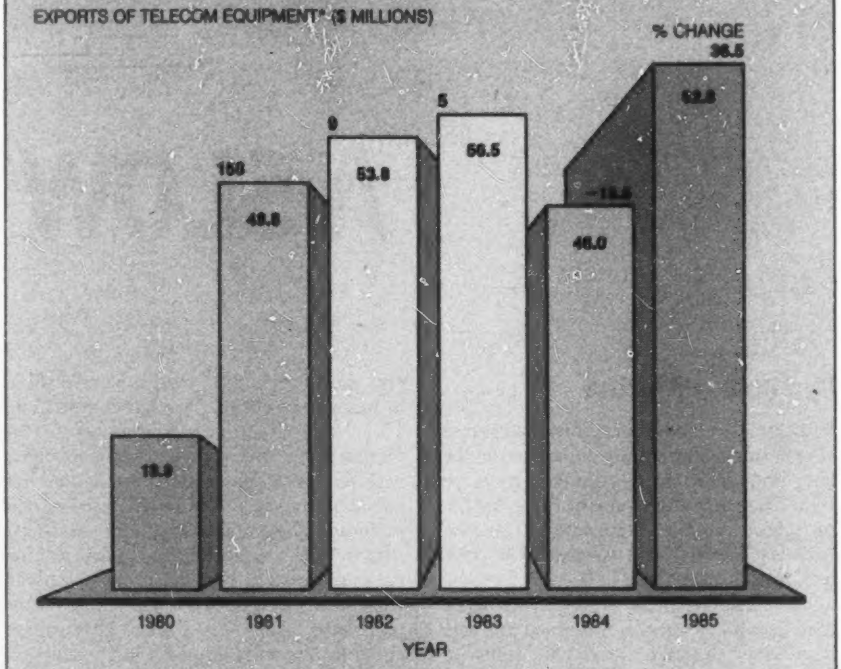
TELECOM FIELD DIFFERENT

It's a different story in the telecom field, where firms like Fujitsu hope that technology training will give them a leg up on their foreign competitors. So far, Fujitsu has floated successful Indian tenders in three areas—fiber optics, microwave relays, and digital mulitplexors.

"Our bids are strong because we are competitive not just in pricing, but also in operating reliability and training," claims Takashi Suzuki, Fujitsu's manager of communications systems marketing for Southwest Asia. "We have a policy of offering comprehensive training that we hope gives us an edge over European and American competitors. They still often sell technology in a black box, leaving the Indians to figure it out."

The black box approach contradicts India's desire to foster self-reliance and the ability to tailor technology to the nation's needs. The Center for Development of Telematics (C-DOT) in New Delhi is one ex-

FIG. 2
JAPAN'S TELECOM EXPORTS TO INDIA



*INCLUDES WIRE AND WIRELESS TELECOMMUNICATIONS EQUIPMENT, COMPONENTS, AND PARTS.

SOURCE: MINISTRY OF INTERNATIONAL TRADE & INDUSTRY'S SOUTH ASIA DIV. AND DATAMATION ESTIMATES.

FROM SHRIMP TO SOFTWARE

It's a long way from shrimp to software, but India is hoping it will be able to close that gap by exporting to Japan more computer programs than crustaceans by the year 2000. In 1984, Japan imported $247 million worth of shrimp from India—roughly the same amount of revenue the Asian nation hopes to pull in from software sales to Japan by 1990.

India wants to use this software hook to nail Japanese hardware technology. "In international negotiations for economic cooperation, you have to give something to get something," explains Paratha Das, counselor for science and technology at the Indian embassy in Tokyo. "Japan is trying to develop software expertise because its computer industry needs to be as strong in software as it is in hardware. It seems reasonable that Japanese corporations should share hardware technology with India to get software technology."

While this sounds like a great idea in theory, the Japanese are skeptical about how it would work in practice. Cultural and linguistic differences are the first stumbling blocks that crop up when considering such deals. "The policy of a software-hardware exchange is a good idea, but it would be difficult to realize on a wide scale," cautions Masafumi Misu, an advisor to Hitachi's board of directors. "One reason is that English isn't very popular in Japan. Since software development is abstract and requires an extensive ability to communicate, it would be difficult for Japanese to work with Indians."

"India wants to export software to Japan, but we have different business practices, so there will be problems," adds Yasuo Fujimoto, a South Asia specialist for the International Trade Policy Bureau at Japan's Ministry of International Trade & Industry. "Even if Indians can adapt to the needs of our business culture, then success in the Japanese market will still depend upon the price and quality of the software they produce."

Ironically, cultural differences may help Indian software score big with Japanese end users. "I don't see why India can't become a major software producer for many different requirements," reasons Edward Ploman, vice rector for the global learning division of the United Nations University in Tokyo. "Indians are born tinkerers and the nation has a tradition of excellence in mathematics and basic science. This combination of skills establishes the intellectual infrastructure needed for producing software.

"The Indians know what diversity is because they live with it," explains Ploman. "In contrast, the Japanese have made uniformity their strength. In its obsession with quality control and uniformity, Japan is stronger than any other nation—not just India. Quality control is necessary but not sufficient for producing good software. You need something else, a different way of looking at things. Japan can benefit from greater cooperation with India in this area. If these two cultures can reach an understanding, they would complement each other."

Looking for such complementary setups, NEC is currently considering an Indian offer to provide software support for the systems it sells in India and elsewhere. "The Indians say they have software capability, so we're planning to use it to support the mainframe systems we'll supply for the department of electronics' National Informatics Center Network," says Tadaharu Kobayashi, manager of NEC's Southwest Asia division.

Another NEC need on the software side that the Indians might be able to answer is for program conversion. "If we supply computer systems to users of IBM, CDC, or DEC systems," continues Kobayashi, "there's going to be a need for software conversion. In this area, Indians can utilize their capabilities. But at the moment we don't know enough about the quality of their software. If we can successfully cooperate with India in this area, we may set up software centers there in the future."

The education that such centers provide will be sorely needed if India hopes to build its software muscle. "Additional investment in education and the experience that comes with time should help spread software skills beyond the educated elite," points out Tsugio Kusajima, director of the international communications department of the Japan External Trade Organization. Kusajima, who recently returned from a fact-finding trip to India, says that "the software market in India has great potential, but it's not yet ready for harvest. Once IBM returns to India the stakes change. Japan is watching and waiting."

One Japanese company that has already successfully used Indian programmers for modifying an applications software package is JSE International. Working with software house Stella Systems in the States, JSE developed dChart, an add-on graphics utility for a microcomputer database package. The software was modified in India to run on an IBM PC for overseas market consumption.

Cutting costs was a key consideration in using Indian progammers. "In order to be successful overseas, it's going to be increasingly important to get quality programmers at a cheaper price than they would cost in Japan," explains Bill Smale, executive vp for JSE International.

Smale's initial success with Indian software underscores the complementary nature of two different dp cultures. "India offers the programming know-how and resources at a more moderate price than the Japanese software industry can. But equally important is the fact that Indian individualism is available to Japanese who need that facet of creativity for moving a software product from a Japanese culture to foreign cultures. Much of that software resource can be found in the Indian people who used to work for IBM. They have the Western individualism combined with Eastern patience that makes the Japanese feel comfortable."

—T.M.

ample of Indian efforts to develop appropriate communications technology. Both NEC and Fujitsu have working relationships with C-DOT.

"Western communications equipment has seldom been designed for operating conditions in developing countries," points out Edward Ploman, vice rector of the global learning division at the United Nations University (UNU) in Tokyo. "India is going after high technology from a very basic level and building up the types of sophisticated equipment it needs that will work under severe operating conditions with very low maintenance requirements. Some Japanese companies recognize that they have much to offer and much to learn by participating in such projects."

The Japanese are already looking for ways to capitalize on India's experience in developing appropriate technology for third world countries. NEC, for instance, is considering tapping Indian know-how for Middle Eastern markets.

"Our Indian associates have offered to supply operational maintenance for telephone switching equipment we sell to countries in the Middle East," reveals Tadaharu Kobayashi, manager of NEC's Southwest Asia division. "We think the proposal is worth considering. This is one type of cooperation that would benefit both NEC and India."

It looks as if India's penchant for self-reliance is beginning to bear fruit. Using competition to wrangle the best deals out of multinationals is slowly allowing the nation to develop the technological base for an indigenous dp industry. But too much reliance on American multinationals represents a risk that India can reduce by continuing to seek closer ties with Japan.

"Although it's not something you publicize, the Indians know there is a risk in becoming too dependent on the U.S.," surmises UNU's Ploman. "Foreign policies can change. Who knows what will happen tomorrow? Perhaps the U.S. will increase restrictions on the export of high technology. The Japanese might take longer to make a commitment, but they might be a safer bet for India in the long run because they are less likely than the Americans to capriciously change policies." ◉

Budget growth will be sluggish this year, as spending for personal computers and consultants slows.

1986 DP BUDGET SURVEY

by John W. Verity

Now entering its second year of economic difficulties, the computer industry may find this year as hard as last, if 1986 data processing budget forecasts are any indicator. Perhaps harder.

Growth in dp spending has slowed significantly during the past year. A random sampling of dp budgets from some 600 U.S. sites shows an average increase over 1985 of only 4.2%. Compared with the 7.4% average increase recorded in a similar survey last year, this diminutive rise seems to bode poorly for industry orders and signal a general tightening of belts among users.

Among the entire universe of respondents, the average total budget expected for 1986 in this year's DATAMATION Data Processing Budget Survey is $1.72 million, $70,000 more than the $1.65 million budgeted in 1985. Among the smaller group of Fortune 1,000 companies responding to the survey (see "Survey Method"), the average total budget is expected to move only slightly, if at all—to $3.2 million in 1986 from $3.15 million last year.

The slowdown in dp spending growth reflects, but nevertheless seems to exceed, poor growth in annual corporate revenues. Most sectors of the current economy are still relatively stagnant. While the average dp budget will increase by 4.2%, the 1986 survey finds that average corporate revenue is expected to rise only 3.1% this year over 1985.

Growth among the smaller companies surveyed this year—those not included in the Fortune 1,000 list—was expected to rise by a much higher rate, 13%. Their dp budgets promised to rise faster as well—6.6%, compared with the 5.5% increase among Fortune 1,000 companies.

So, even as Wall Street, IBM, and the industry as a whole fret and try to live without the heady rush of growth they experienced just a few years ago, dp spending is, in fact, a bright spot in an otherwise fairly bleak economic landscape, a sign of strength that other economic sectors will find hard to match. Don't give up yet on this year's contribution to the "information age."

While the strongest growth in dp budgets between 1985 and 1986 was found in such industrial sectors as computer manufacturing and utility communications, several sectors, including education and government, predicted a decline in their dp spending this year.

A look at individual line items in the budget survey reveals shifting spending patterns among large and small users as they attempt to consolidate and rationalize the widespread installation of personal and departmental computing gear.

For the second year in a row, spending on personal computers has tapered off. Prior to 1985, surveys showed fantastic growth in this category as millions of the small machines were installed into every nook and cranny of the corporation. The machines were so inexpensive and seemingly useful that in many cases they had become status symbols to be ordered merely for appearance's sake. Just about all those who could productively use a personal computer had access to one by last year, it seemed. Budget administrators then began to

FIG. 1

THE TYPICAL DP BUDGET

BUDGET ITEM	ALL SITES		FORTUNE 1,000 SITES	
	1985	1986	1985	1986
Personnel	31.3%	32.6%	33.2%	34.2%
Mainframe cpus	12.2	11.9	15.4	15.4
Minicomputers	10.8	10.4	9.0	8.2
Mass storage/memory	3.4	3.2	4.6	3.6
Terminals	4.1	4.0	5.0	4.6
Single-function desktops	0.5	0.4	0.5	0.6
Personal computers	9.2	8.6	5.2	5.9
Printers and peripherals	3.4	3.1	3.3	2.9
Applic. software (nonpc)	2.7	2.9	2.4	2.3
Systems software (nonpc)	1.9	2.1	2.1	2.1
Pc software	2.3	2.1	0.9	1.0
Data communications	2.7	3.5	3.1	4.3
Consultants	1.8	1.5	1.6	1.1
Outside services	3.7	3.3	3.0	2.6
Supplies	6.3	6.7	6.0	6.4
Overhead, rent	3.7	3.7	4.7	4.7

FIG. 2

CHANGES IN DP BUDGETS BY INDUSTRY, 1985 VS. 1986

INDUSTRY SECTOR	ALL SITES	FORTUNE 1,000 SITES
Survey Average	4.2%	5.5%
Manufacturing—edp	2.2	6.2
Manufacturing—other	2.8	3.2
Edp services	6.2	−0.3
Government	5.9	NA
Education	3.9	NA
Finance	7.2	5.6
Retail/wholesale trade	9.1	0
Medical/legal services	5.4	0
Transportation	0.3	−0.1
Utilities/communications	9.7	12.6
Construction, mining, agriculture	2.9	0
Other business services	1.3	−4.8

hold back on spending for more. While no one knows whether or not yesterday's personal computers are sitting idly in a closet somewhere, spending on pcs as a fraction of total dp spending will be down again this year. Where 1985 respondents said that 9.2% of their total budget went to pcs, this year they will spend only 8.6%. That is a considerable 6.5% average drop in that category's share of overall dp budgets.

The average drop in pc spending, however, masks important differences between Fortune 1,000 companies and smaller business concerns. Among the Fortune 1,000 companies, which buy in quantity and often resell personal computers as part of their product offerings, spending in this category will go up by 7.6%—to 5.9% of the total budget from 5.2% last year.

Pc spending among small companies, on the other hand, will show a 12.6% decline—to 9.7% from 11.1%.

The survey also revealed a severe fractional drop in spending for single-function, desktop systems, which reflects the personal computer's widespread popularity, its ubiquity as a standalone computing device, and its technical flexibility. This category includes the word processor, which evidently has long passed its liveliest days.

DROP IN SINGLE-FUNCTION

Compared with the average 8.6% of their budget that dp managers will spend on pcs this year, they will spend only 0.4% on single-function desktop systems. Among all sites surveyed, this category's fraction of the total dp budget will fall 20%, to 0.4% from 0.5%. Among the largest responding companies, however, there will be a slight increase (to 0.6% from 0.5%).

The personal computer's widespread impact is evident throughout the survey. The budget categories of data communications and nonmainframe system software show particularly strong gains this year. Apparently users are moving to connect the many standalone systems they've installed over the past few years. Local networks, PBXs, and other connection schemes are widely expected to show strong if not excellent growth this year.

Users will be trying to do more for themselves in the months ahead, writing more of their code and planning more of their systems. Taken as a whole, they will depend less on independent consultants and have budgeted 17% less in specified funds for this kind of help than they did last year. By the same token, spending on outside services, such as timesharing and contract programming, is expected to drop as a percentage of the whole dp budget—to 3.3% of the total, on average in 1986, from 3.7% last year.

Ironically, however, users are building data communications into their systems more than ever. The complexity of those connections would generate, it would seem, more need for outside expertise. In any case, datacom spending, apparently driven by the need to tie personal and departmental computers together with mainframes, stands to go up by an average of 30% in 1986 compared with the previous year. Among Fortune 1,000 companies, datacom spending will be up 44.4% as a share of total dp spending. Among the remaining firms, growth will be a not inconsiderable 24%, according to the survey.

Again, as seen last year, a declining share of dp budgets has been set aside for mainframe processors. Compared with the average fraction of 12.2% marked for mainframes last year, in 1986 there will be only 11.9%—a small, but continuing, 2.4% decrease. Among Fortune 1,000 companies, who provide IBM and other mainframers with most of their revenues and profits, mainframe spending seems to be just holding its own. It remains at 15.4% for the second year in a row.

As a fraction of total spending, mass storage and memory will be down even more, by 5.9% on average and by 30% among Fortune 1,000 companies. It's not clear why there are such decreases, however. It's widely believed that disk drives are being installed at a high rate to keep up with growing on-line applications and databases.

The minicomputer category has seen a drop, too. On the whole, respondents said they had used 10.8% of their 1985 budgets on minis, but they would use only 10.4% this year. The large, Fortune 1,000-class sites showed a slightly steeper drop—to 8.2% in 1986 from 9% in the previous

A
$1495
PC/AT

Is This a Joke?
A ★ Hoax?
A ★ Trick?
A ★ Put-On?

No, it's an **A ★ Star**™! And, unlike most of its would be competitors, it's none of the above. What it *is* will astonish you! At $1495*, **A ★ Star** is by far the lowest priced PC/AT compatible on the market. But, it's not just another clone, it's better!

A ★ Star™ runs 30% faster than most AT's, has twice the memory and eight *available* expansion slots; theirs has only seven. Plus, **A ★ Star** is so "compatible" it's backed by an exclusive money back guarantee. Better yet, **A ★ Star** is the only "network ready" AT you can buy... at *any* price.

But that's not all. **A ★ Star**™ is also the only PC/AT compatible made in America by an American Stock Exchange manufacturer. And that's real peace of mind when you consider the unknown origin and quality of many of the cheap, import imitations.

A ★ Star™ It's about time!

Wells American
3243 Sunset Boulevard
West Columbia, South Carolina 29169
(803) 796-7800 TWX 510-601-2645

*Second unit price. Call for first unit pricing and guarantee details. You'll be amazed!

CIRCLE 37 ON READER CARD

Users will be writing more of their code and planning more of their systems in the months ahead.

SURVEY METHOD

The 1986 DATAMATION Data Processing Budget Survey attempted to reach a cross section of United States users from a wide variety of industrial sectors. Results were tabulated for all sites, for sites that are listed in the Fortune 1,000, and for those that are not on the Fortune 1,000. As such, the poll was designed to reflect the magazine's readership.

The survey began in early December when 5,000 questionnaires were mailed to a random sample of DATAMATION subscribers. A total of 608 responses were received by Jan. 10, a third coming from Fortune 1,000 sites.

Almost half (47%) of the responding individuals identified themselves as managers in computer/systems operations; another 19% are in corporate management. As for industry sectors, the largest category of responding companies was nondp manufacturing at 26%, followed by computing services at 12% and finance at 11%. Some 71% of the responding sites were the headquarters of their respective organizations.

The respondents indicated an average of $291 million in yearly corporate revenues for 1985 and an estimated $300 million for 1986. The average data processing budget for 1985 was $1.65 million and is expected to be $1.72 million this year. For 1986, for instance, they range from less than $10,000 (7.1% of the total sample) to more than $5 million (14% of the total). The average employment for all sites was 2,280 people during 1985, but a quarter of the companies (156 sites) had less than 100 employees in total.

This year's survey did not ask about spending on data processing goods and services that takes place outside the official data processing budget itself. Previous surveys have found such outside spending to be relatively significant. Because of that and some other minor changes, this year's dp budget survey is not directly comparable to the one taken last year.

—J.W.V.

year. Unlike some other software categories, microcomputer software as a whole is expected to show an average decline in its share of total budgets—the category stands to experience an 8.7% drop, to 2.1% this year from 2.3% before. The drop is even greater (13%) for non-Fortune-class sites.

Excluding personal computers, applications software is gaining increased budget attention. Its share of the pie last year was 2.7%, but this year it will garner 2.9%. In contrast, among Fortune 1,000 sites there promises to be a drop (a perhaps insignificant 3.7% decline) to 2.3% from 2.4% of the total.

MINI & MICRO SW IS UP Minicomputer and microcomputer systems software will probably do much better than applications software. Users on average are expecting to devote 2.1% of their total budgets to mini and micro software, up about 10% from last year's figure of 1.9%. Evidently, small sites will boost their spending in this area even more, about 11% from 1985 to 1986.

Overhead expenses, including such items as utilities and rent, remained level, as a whole, claiming an average of 3.7% of the total dp budget. Supplies, on the other hand, took an increased share of 6.4%, to a total of 6.7% of the total dp bill.

As always, the biggest budget category is personnel. On average, 32.6% of the total 1986 dp budget will go toward salaries and other personnel expenses, up a slight 4.2% from last year's share of 31.3%. This fractional growth was slightly lower among large, Fortune 1,000 sites, where this year's share will be 34.2%, only 3.2% higher than last year.

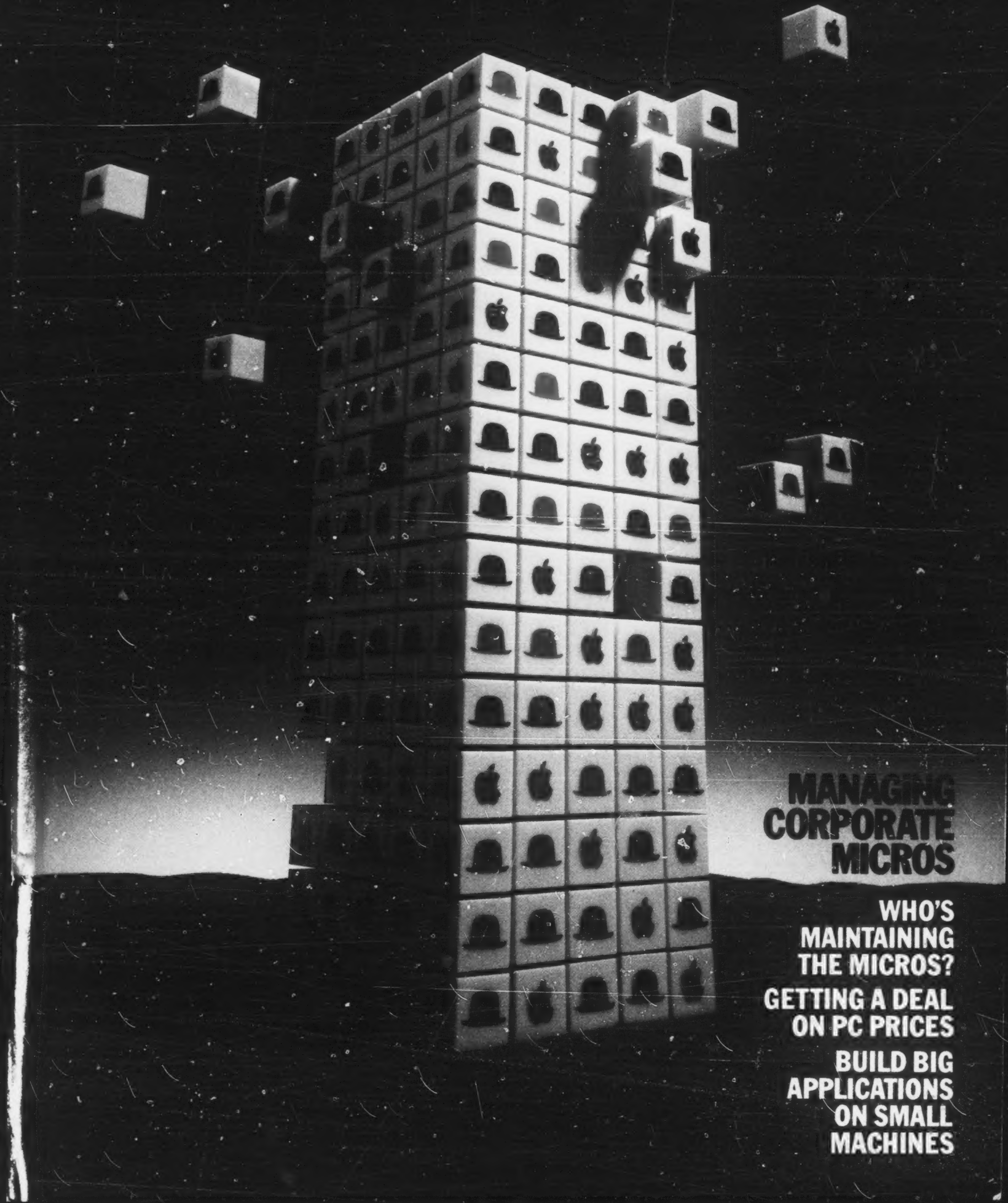
The average site in this year's survey employed 24.9 dp people last year. But cost-cutting is the name of the game this year and, as a result, that number is expected to rise to only 26.1. The largest, Fortune-class sites will see average dp employment go to 43.8 persons this year from 42.8 last year; smaller sites were found to have a higher employment growth, up 8.2% to an average of 17 people this year.

For the first time, this year's survey delved into the factors that determine future budgets. Users as a whole indicated that company growth is the main influencing factor, followed by expenditures for the prior year, new software products, and personnel costs. Evidently, the rise of software product prices, especially important systems software from IBM, is making itself felt on the dp shop's bottom line. ◉

The complete 1986 data processing budget survey, including data from all industry sectors and company size categories, is available from DATAMATION for $150. To order a copy, please call Laurie Schnepf, director of market research, at (212)-605-9679.

C8650-1

OEM EDITION APRIL 15 $3 © TECHNICAL PUBLISHING



MANAGING CORPORATE MICROS

WHO'S MAINTAINING THE MICROS?

GETTING A DEAL ON PC PRICES

BUILD BIG APPLICATIONS ON SMALL MACHINES

DATAMATION

APRIL 15, 1986/$3 U.S.A.
VOLUME 32 NUMBER 8
This issue, 191,425 copies

FEATURES

68
BEHIND THE NEWS
Hollywood's appreciation is increasing for the role computers play in moviemaking. Edith D. Myers reports that now even "Oscar Computes."

82
WHO'S MAINTAINING THE MICROS?
David Stamps
Some users figure they can beat the cost of a service contract by buying service by the job. Others go for the do-it-yourself approach.

91
STALKING THE WILDS OF THE PC MARKET
Hesh Wiener
An emerging street market, where wholesalers and mail-order houses sell both brand names and generics, offers a low-priced alternative to the traditional sourcing provided by manufacturers, authorized dealers, and commissioned salespeople.

96
MICRO APPLICATIONS DEVELOPMENT
Ken Michielsen
By using the right software tools and by applying traditional system life cycle methodology, the pc can be a cost-effective alternative to applications development on mainframes.

103
WALL STREET: CAUTIOUSLY UPBEAT ON MICROS
Liz Hecht
Analysts predict that technological advances in hardware and software, emerging networking capabilities, and higher-performance systems will facilitate new applications for micros and act as a spur to overall demand.

110
THE HIGH-TECH EXPRESS
Ron L. Skelton
Get on the right track by adapting the best available technology.

117
GE'S ELECTRONIC CORPORATE LADDER
Jeffrey L. Craig
The Computing People Project is a comprehensive personnel placement program that will eventually make both a list of companywide job openings and an up-to-date inventory of computer personnel accessible from a pc workstation.

NEWS IN PERSPECTIVE

26 **SUPERCOMPUTERS**
Who's in charge here?
28 **SOFTWARE**
Whose turn to cry?
36 **MINICOMPUTERS**
Proof of the pudding.
42 **TURNKEY SYSTEMS**
Gotta be in to win.
59 **NETWORKS**
On the edge.
64 **BENCHMARKS**
76 **WORLDWATCH**

DEPARTMENTS

9 **LOOK AHEAD**
14 **CALENDAR**
19 **LETTERS**
23 **HARDCOPY**

123 **HARDWARE**
129 **SOFTWARE**
134 **LOOKING BACK**
137 **READERS' FORUM**
138 **SUBJECT INDEX**
140 **ADVERTISERS' INDEX**

OEM SUPPLEMENT 80-1

- 1 **FINDING THE CASH**

COVER PHOTOGRAPH BY WALTER WICK

Venture, institutional, and public financing are available to resellers, but only to those who add value.

FINDING THE CASH

by Stephanie Miller Hills

A good idea is the first step. Hard work, finding a niche, and filling a need in the marketplace get a value-added reseller (var) up and running. But cash is the fuel that keeps the company growing. In order to find that cash, entrepreneurs must convince people who have little knowledge of reselling to invest in their firms.

Raising money to fund a reseller operation was never easy, but it appears that, this year, financial markets are opening up slightly. Some of the luster that high-tech companies had during their boom in the early 1980s is returning, although investors are more selective after suffering through the tough years of 1984 and 1985.

Communication is the key. Bankers, underwriters, and venture capitalists are willing to invest in vars but need to be educated about the market the reseller plans to serve and its opportunities.

The problem is that entrepreneurs and financiers speak different languages and have different perspectives on the computer business. It is up to the savvy entrepreneur who might already know how to sell his product to learn the language of the banker.

"The hard part for the entrepreneur is that he does not know how to do what he is going to have to do—get people to put money in his company," says Larry Fisher, president of Fisher Business Systems Inc., a var in Atlanta. "You're faced with the toughest challenge of all: running your company while you're out trying to raise money. That's the greatest pressure, and it's very difficult not to let one [of these efforts] suffer. Typically, you don't have anyone to whom you can turn over the reins."

For companies that need to raise $500,000 or more, the first place to look is the venture capital market. Arranging startup capital is the most difficult step, because a company often has few assets and no track record. In return for making an investment at this stage of the game, venture capitalists usually want a significant share of the new firm's equity—up to 80%—as well as the opportunity to participate in the company's management. Says Jeffrey Hamilton, a general partner with Euclid Partners, a New York venture capital firm, "If you're in a very early-stage startup with an untested management and product, you could put in a modest amount of money and get 30% to 40% of the company."

FISHER OF FISHER BUSINESS SYSTEMS: "The toughest challenge of all: running your company while you're out trying to raise money."

Venture capitalists believe that resellers have never ceased to represent an attractive investment opportunity for the financial community.

"The interest in the var business where you're packaging hardware, software, and peripherals for a particular market segment has always been there and is reasonably constant," says Hamilton. He distinguishes between these vars and those that just sell hardware without adding value in the form of proprietary technology, however.

Too often, the success of the var that simply moves hardware is a function of the policies of the hardware manufacturer. "It's always risky," Hamilton explains. "The big company could change the ground rules and wipe out the margin these smaller outfits generate from the hardware. [That margin] changes over the product life cycle."

VERTICAL MARKET INVESTMENT

Norman Fogelsong, general partner in the Mayfield Fund, a San Francisco-based venture capital firm, says he is willing to capitalize vars, although he looks at it as an investment in a specialized vertical market operation. "Our greatest interest is in individuals who have bootstrapped a product and are now at the point of taking it to the market and want to expand its distribution," he says.

Because of the nature of reselling, the analysis of the investment opportunity is different from what it would be for, say, a hardware manufacturer. "With a var, there is less likelihood of a unique proprietary technology," says John Shoch of the Asset Management Corp. in Palo Alto, "so you don't look for that in assessing the attractiveness of the deal. You look at the market and how the business plan is being executed."

Euclid's Hamilton agrees that the marketplace is the key. "Is the marketplace and the segment of the marketplace significantly attractive in terms of its size and growth potential?" he asks. "The greatest opportunity and product, if not executed well, will not work out. It all depends on the management."

It is in this area where venture capitalists often rely on instinct. Good communications skills can greatly enhance the attractiveness of the investment opportunity. "You don't know for sure about the management. You just spend enough time with the people and check them out and what they've done before. If you feel sufficiently impressed and you have the terms,

Some of the luster that high-tech companies had during the boom in the early 1980s is returning.

you go with them," says Hamilton.

Before the entrepreneur takes on new investors, he should review what he is getting in return. While the investors might be asking for 30% or more of the young company's equity, the owner should be wary of selling too much at a wholesale price. Larry Fisher found that the investment companies wanted to take 10% of his company in exchange for a $200,000 investment, a price he thought was too high. Usually, there are some incentives included in the deal where the entrepreneur can buy back a percentage of the company if it meets specified performance criteria.

Venture companies typically participate in the management of the company and take one or more seats on its board of directors. Each venture firm has different guidelines, and the degree of participation is based on the timing of the investment.

In the first round of financing, the entrepreneur has to ask what services he will be getting. If a var's investors can provide management guidance and help find future investors, it might be worth additional equity. For a company founded by technicians, this kind of investor participation can be an invaluable asset and an inexpensive way of getting high-priced administrative talent involved in running the company.

"In the early stages of startup, we spend a lot of time on the effort, assisting with staffing, planning, and testing the market," says Hamilton. "I've even gone out and helped a company market its product, because a lot of large companies are leery of buying from startup companies. They question whether [these new firms] have the financial resources. By going with them, you're standing behind them with the resources you have available."

This collaboration can be successful, however, only if the company's management and its investors can work together as a team. "If you don't feel that the investor has confidence in you, it's hard to have a good deal," warns Fisher. "It's hard for a small company to accurately forecast what it will be doing in the coming years, so sometimes you'll be behind plan. If you start out in an adversary position, it will get worse."

Resellers are best advised to seek investors who have funds available for the next round of financing or who know other investors. In this second stage, who the investor knows can be as important as what he knows. The venture firm also should be able to help with the selection of an underwriter when the company is ready to go public. It is important to keep in mind that, when assessing a purchase, stock market investors often look at the quality of the venture capital firms that have money invested in the company.

Typically, venture capital firms are more interested in companies in the second stage—with a proven track record and at least approaching profitability. Capital invested by venture firms in later-stage financing, as opposed to startup, rose from 25% in 1981 to 30% in 1984.

In the second round, the entrepreneur should be able to choose between competing venture firms, allowing him to cut a better deal and retain more control. In later financings, the company's valuation should be higher; the entrepreneur should receive more capital in exchange for selling less equity.

Going to a bank can be an alternative to later-stage equity financing. Commercial banks are courting smaller companies aggressively, although they usually stay away from startup situations. Donald Cvietusa, the head of Bank of America's high-tech lending area, says of the amounts and clients his group works with, "There are no minimums and, theoretically, no maximums; everything starts small. [When evaluating] a var, I would look at the product lines the var supports and whether those are likely to sell with the systems they put together, the market they are in, and the competition."

MORE THAN PEDDLING HARDWARE

Like venture capitalists, bankers insist that the resellers who come to them for financing do more than peddle some other company's hardware. Michael Yahng, head of the new ventures group at the First National Bank of Boston, says his bank will talk with vars but notes, "We're not too interested in lending to companies that don't add value. If there's no real technology that they're bringing to the party and all they're doing is being the middleman, that would not be attractive to us." He adds that the bank will consider deals with a minimum credit of $200,000, provided the company is in a region where the bank has other clients.

The interest rate the banks charge is a function of the strength of the company. Says Cvietusa, "The interest rate is determined by the [company's] size, [loan] term, and a judgment call on risks and administrative costs." The rates charged by these lending groups range from prime to prime plus 3%.

To approach a bank or venture capital firm, a company needs a business plan and past financial statements. "We like to see a company with a hockey stick profile that will be a meaningful and standalone company of $25 million to $50 million within five to seven years," says Yahng.

Many vars have few assets to support a loan, and they believe debt financing is not available to them as a result. Although banks prefer assets that are free and will use them to support a credit when the company is marginal, this is not absolutely necessary. If a company is well established, banks may consider the loan without attaching any assets.

Banks do not participate in the management of a company, but closely track their customer's progress against its plans and forecasts. Firms with proven track records can have their choice of banks. Tony Onorato, treasurer at TSR Computers, a Hauppauge, N.Y., var, went to several banks before he got a loan at prime. His company has a strong balance sheet and is very liquid with no long-term debt—all factors that appeal to bankers. "We had a choice of bank financing, bonds, or equity, but decided to save the other options for major purchases or acquisitions," he recalls.

Entrepreneurs should select the bank they work with not only based on the interest rate, but also on the services the bank offers. First National Bank of Boston, for example, provides cash management and international services, as well as stock transfer services and advice on choosing an investment bank when a company is ready to go public.

BIG ASSET DOESN'T SHOW UP

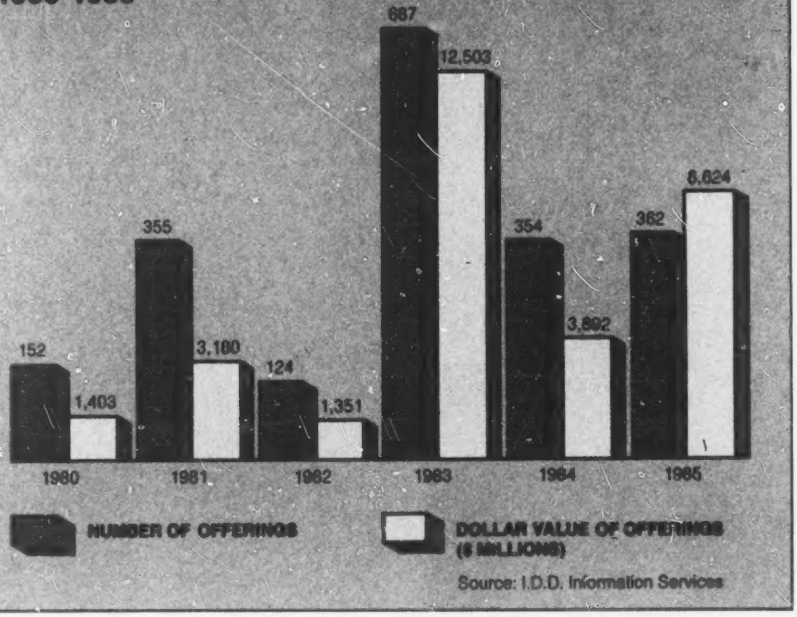
A problem in dealing with banks is that one of the vars' biggest assets is not fully recognized on the balance sheet. "My restaurant system that I wouldn't sell for a million dollars is valued at $50,000," says Fisher. "When you talk to a banker, all software companies look crappy." He got around this problem by building a good reputation with several banks over time, starting with an auto loan.

Fisher believes the secret of success with banks is keeping them up to date on how and what his company is doing. "It seemed logical, if they were going to be my partner sooner or later. Even when I had a small line of credit, I would go every quarter or six months and give them a status report. The difference between a reason and an excuse is [timing]. If you tell them that it is not going well this quarter and you have to borrow more money, it's no big deal. When you go rushing in at the eleventh hour, you begin to establish [a different] reputation."

There comes a time when a company's financial needs exceed even the deepest

FIG. 1

THE MARKET FOR INITIAL PUBLIC OFFERINGS: 1980-1985



Source: I.D.D. Information Services

pockets of the venture firms and the loans available from banks, and the stock market becomes an important source of additional capital. The initial public offering (IPO) market reached a peak in 1983 when a record $12.5 billion was raised by 687 companies, according to IDD Information Services in New York (see Fig. 1). Unfortunately, that pace has slowed, especially for high-technology stocks whose multiples reached dizzying proportions in the heyday of the IPO market.

"I would not say that people are chomping at the bit to get their hands on technology issues, but I would say a deal is possible now, which couldn't be said a year ago," comments Robert Natale, editor of *Emerging Issues and Special Situations* at McGraw-Hill Inc.'s Standard & Poor's unit. "The IPO market takes its lead from the general market conditions. The stock market has been good over the last couple of months, and technology issues have rebounded to some degree."

The IPO market is a definite possibility for VARs, confirms Chris Covington, the director of corporate finance at regional investment firm Robertson, Colman & Stephens in San Francisco. He adds that Wall Street is little bit skeptical and for a familiar reason. "The question at hand is how great is the value added of value-added resellers. With IPOs, people are looking for continued growth."

Covington says that he would want to see historical and forecasted financial information, a business plan, and a well thought out strategy from companies considering going public. They also need to show a customer list, provide references, and include résumés of the executive management.

STOCK CAN BE BEST FINANCING

When the market is hot, the value placed on a company's stock can far exceed any other type of financing, notes Robert Riopel, executive vice president for finance at ASK Computer systems, a Los Altos, Calif., reseller. His company's stock sold for a multiple—defined as the price of the company's stock divided by its earnings per share—of 40 times historical earnings.

Unfortunately, multiples like ASK's seem to be a thing of the past. "When we had our initial offering, the world was starting to realize that companies like ours could grow to a significant size," Riopel remembers. "Everyone wanted to invest in the software market in 1982 and 1983, [but] from mid-1984 on, no one wanted to touch it. Now there seems to be more willingness to look at the individual company."

Because reselling is not an industry in particular favor with the stock market today, companies attempting to make a public offering need to be larger and more seasoned than in the past. In 1978, firms went public with sales of $10 million and profits of under $1 million, because investors had a sense of the worth of a proprietary position in a growing market.

Covington estimates that companies now need revenues of $40 million to $50 million and a net profit of at least $2.5 million to be of institutional interest and quality. "It's probably an industry of eight to 12 multiples and, as a consequence, in order to be worth being a public company, you have to have a valuation of $30 million and issue stock of $10 million," he says.

Investment banks handle the underwriting chores for an IPO. Because the fees a bank can charge for an initial offering are higher than those charged to an already public company, there is much competition. "The IPO business is a fair-traded item. The amount of the fee depends on the underwriter and the size of the offering," says Covington. Average fees can range from 7% for a $50 million deal to 7¾% or 8% for a $10 million offering.

The less attractive companies have to pay out a greater percentage to the underwriter. But if the banks want to establish a relationship with a company that will offer profit opportunities in the future, the fees will be lower. "There will be many houses banging at the door if [they see a future] need for additional underwriting, either debt or equity," says Natale of Standard & Poor's.

Investors in the IPO market look for companies with good track records, consistent or accelerating sales and earnings growth in successive quarters, backlogs of orders, and managements experienced in running larger firms. Natale believes that investors prefer professional over entrepreneurial management. "Entrepreneurial people often have trouble getting over the $100 million hump," he notes.

The quality of the underwriter and the original venture capital investors affects the offering's market reception. The first-tier investment banks are those that deal primarily with institutional investors; the second-tier banks are regional. The number of shares sold by current stockholders and venture capital investors also affect the offering. If only a few shares are sold by the stockholders, the market will perceive that they are willing to stay with the company. When the percentage of shares sold by a company's investors exceeds 40%, alarms go off in the minds of potential buyers. Such activity demonstrates to the market the small degree of faith the current investors have in the company.

More and more sources of financing are available to growing companies. The deregulation of the banking industry, coupled with new financing tools and increased competition, have worked in the entrepreneur's favor. A good track record and a well-defined business plan are the first steps in opening doors to financial institutions. Knowing the options, making contacts and and keeping them informed should make it easier for resellers to raise the capital they need to keep their businesses expanding. ◉

Stephanie Miller Hills is a free-lance writer specializing in finance and based in San Francisco.

DATAMATION 86

INTERNATIONAL EDITION MAY 1 $3 © TECHNICAL PUBLISHING

1986 MAINFRAME USERS SURVEY

ALSO:

A 3090 UPDATE

MULTICS USERS: BIG LOSERS?

RULE-BASED DATA MANAGEMENT

DATAMATION

MAY 1, 1986/$3 U.S.A.
VOLUME 32 NUMBER 9
This issue, 192,930 copies

FEATURES

54
SEND IT BY SATELLITE
A Datamation Staff Report
Recent advances in the technology and the wide range of related communication services now available have made satellite networking a sensible and efficient option for many companies.

67
1986 MAINFRAME SURVEY
John W. Verity
PCs are down in the office and Sierras are up. Minis are down for scientific applications and workstations are up. These and other findings can be found in the Datamation/Cowen & Co. survey of 3,900 mainframe sites.

78
THE SIERRA, ONE YEAR LATER
Frederic G. Withington
Last May, we looked at IBM's 3090 and prognosticated. Now, an esteemed industry analyst reviews the machine's performance, its disappointments, and its surprises.

86
RULE-BASED DATA RESOURCE MANAGEMENT
Daniel S. Appleton
Herewith, a critical introduction to the still-new field of data administration: what it is, how to do it, and who should run it.

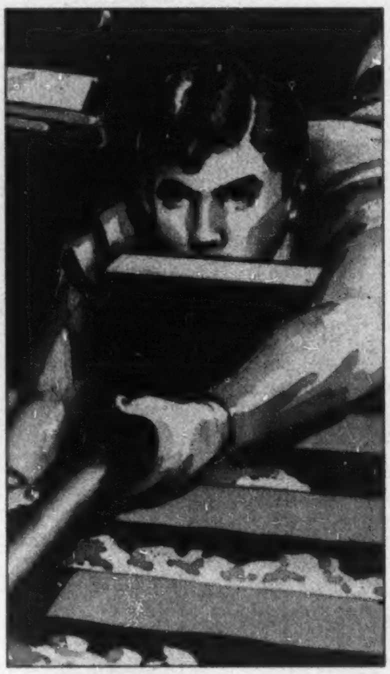
102
MULTICS USERS FACE THEIR MAKER
John W. Verity
Honeywell users say that unless a white knight arrives, their beloved operating system faces a quite *un*-natural, unnecessary death.

NEWS IN PERSPECTIVE

22 **PROCESSORS**
The stakes rise.
24 **SUPERCOMPUTERS**
Planting the flag.
31 **STRATEGIES**
On the road again.
39 **MARKETS**
A new London tradition.
42 **OPERATING SYSTEMS**
An uphill climb.
48 **GRAPHICS**
In the hands of users.
52 **BENCHMARKS**

DEPARTMENTS

9 **LOOK AHEAD**
15 **LETTERS**
19 **EDITORIAL**



117 **HARDWARE**
123 **SOFTWARE**
129 **READERS' FORUM**
132 **ADVERTISERS' INDEX**

INTERNATIONAL 64-1

(DOES NOT APPEAR IN ALL EDITIONS)

-1 **THE ADD-ON APPROACH**
-11 **USING SYSTEMS TO SELL**

COVER PHOTOGRAPH BY STEVE COOPER

1986

MAINFRAME SURVEY

by John W. Verity

Shipments of its PCs have tapered dramatically, but IBM's efforts to enhance deliveries of its 3090/Sierra mainframes have paid off in a swell of orders. Meanwhile, distributed processing is taking stronger hold among other mainframe company sites, but IBM is muscling in to win an increasing share of that business. These are some of the findings of the DATAMATION/Cowen & Co. 1986 Computer and Telecommunications Industry Survey, derived from a poll of spending plans at more than 3,900 North American mainframe sites. More than 2,600 of those sites listed IBM as primary main frame vendor, giving a unique look at installation activity among the industry leader's customers. The polling was completed Feb. 24, and was followed by a selective survey of large-scale IBM sites just after IBM introduced two new Sierra models that month.

There were other interesting items:

- Single-user workstations have now surpassed minicomputers as the systems of choice for scientific/engineering applications.
- In that same market, Digital Equipment Corp. is showing new strength in workstations and minicomputers, winning market share away from both IBM and Hewlett-Packard. Digital is also showing growth in its share of survey respondents' planned small business systems purchases for 1986 and 1987, up to 18% from 8% last year; Wang's share has dropped to 5% from 9%.
- Not counting new users expanding the market, growth in shipments of IBM PC gear to respondents fell 13% since last year; it had been up 19% in last year's survey, and 109% the year before.
- More than half the survey sites (55%) said they had connected personal computers to their mainframes, while an additional 27% plan to do so in the following two years. Most interconnected pcs, however, were found to be used as dumb terminals.
- A decided trend away from large host-based office systems was discovered, even among IBM sites. Instead, departmental-based systems are catching on. At the same time, the use of pcs in office systems appears to be leveling off.

As usually happens during the first year of a new IBM product cycle, the company's mainframe business is quickly centering on the 3090/Sierra line of systems. After just half a year of shipment, the 3090 already comprises more than a fifth of the respondent installed base in dollar terms; 60% ofthe base's value was made up of 308X machines. That mix will take a dramatic shift in coming months, however. In terms of dollar value, the 3090s are expected to dominate the company's shipments in 1986 and 1987. Fully 59% of the total value of systems to be installed by survey respondents during that time will be 3090 gear, followed by 28% for 308X machines, and 13% for 4300 hardware.

Systems in the 303X family are expected to drop to 1% of the total. A large percentage of respondents' planned 3090 installations, 38% to be exact, will go in as totally new systems, not as replacements. According to the survey, another 3% will replace plug-compatible machines, primarily Amdahl's, and 34% will replace 308X hardware.

ROSY OUTLOOK TEMPERED

As rosy as that outlook may seem, its effect on IBM's profitability will be tempered by aggressive price discounting for 3081, 3084, and 3090 systems. Users indicated they received an average 9.8% discount on systems of that size that they last acquired from IBM. Discounts on 4361/41/81 and 3083 machines were in the 6.4% to 6.5% range. (On the other hand, Amdahl and National Advanced Systems [NAS] were found to be discounting by as much as 17%.)

Meanwhile, users are buying—not leasing—IBM systems more than ever, leaving few leased systems to be converted to purchase in the future. Purchase will be the way to go for 95% of the mainframe installations planned by survey respondents for the following 24 months. A heavy concentration of purchasing at the upper reaches of the IBM performance range has left the lease portfolios of both third-party leasing companies and IBM Credit Corp. heavily weighted with midrange systems: about half of each portfolio would seem to be 4300-class leases.

Users' planned peripherals installation activity is up over the previous year in all categories, with IBM the vendor of choice. Just over two fifths of the responding sites said they would add disk drives this year; just under a fifth said they would add tape drives; about two fifths said they would add terminals.

IBM's dominance of the increasingly important 3380-class disk drive market is intact. The company will supply 86% of the disk drives respondents said they will install during 1986 and 1987. Of the plug-

FIG. 1

NEED FOR ADDITIONAL CPU AND DISK CAPACITY GREATEST AMONG IBM'S LARGE SYSTEMS CUSTOMERS

Query: How well set is your organization currently in terms of already-installed capacity for its 1986-1987 processing needs?

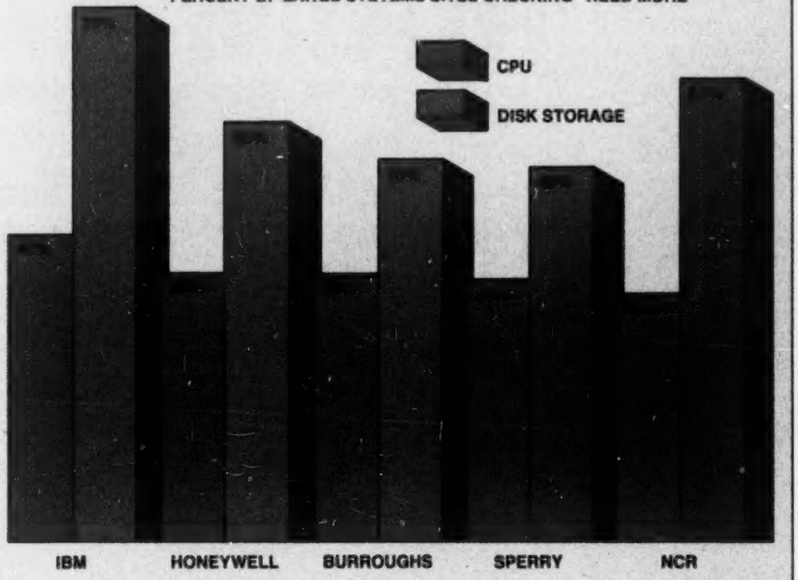
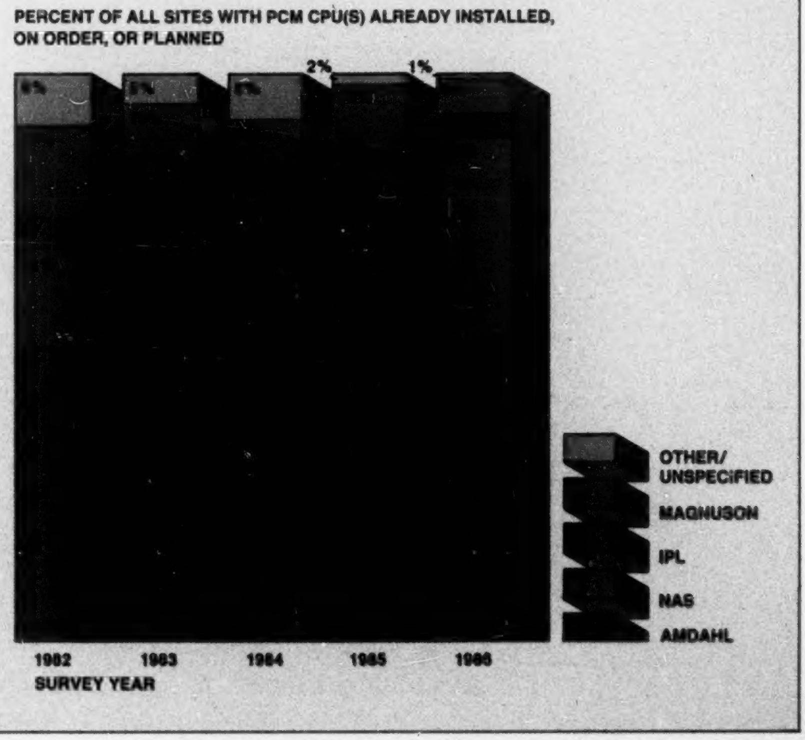


FIG. 2

AMONG PCMS, NAS GAINING MOST GROUND



compatible companies, Storage Technology can look forward to doing the best, with 5% of the planned total (up from only 2% in last year's outlook). Amdahl and NAS, both selling Japanese-made drives, will pick up another 2% each. Double-capacity 3380 drives promise to account for 42% of the installations for this 24-month period. As a fraction of the total number of DASD bytes installed with respondents, 3380-class drives now account for 83%, up from 78% last year.

IBM SALES OF TAPE DRIVES UP With its 3480 tape cartridge unit in volume production, IBM carried into this year its '85 resurgence into the tape drive market, which it had let slide to Storage Technology and others in recent years. The survey showed that IBM stands to install 65% of the tape drives going in this year and next, off a bit from its 67% in last year's survey; StorageTek should get 14% of those units, down from 23% last year; and Memorex can expect a mere 2%, half its expected take last year.

In the crt terminal arena, IBM may also lose a few points of share, dropping to 59% from 63% last year. Gaining ground will be ITT-Courier, up to 10% from 4%, and Memorex, up to 5% from 2%.

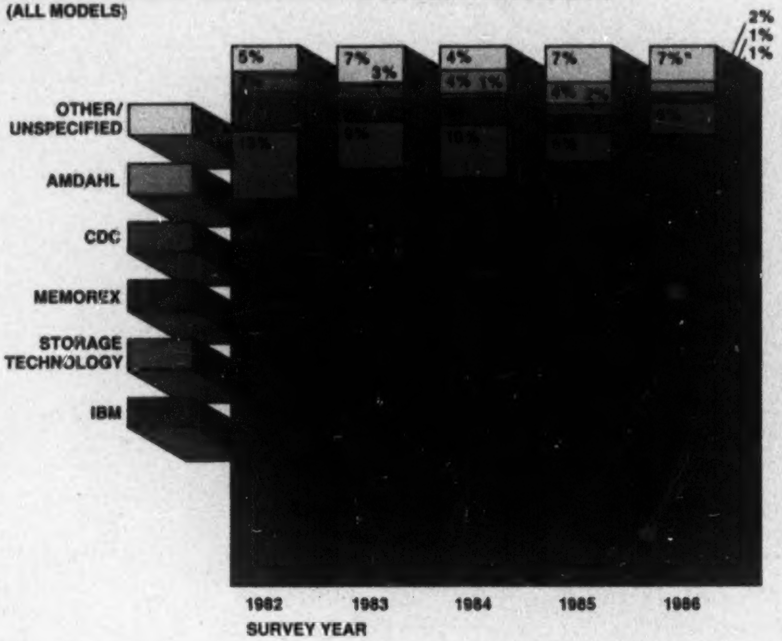
The need for extra capacity during the following 24 months is expected to be greatest among sites using large-scale systems, but in general there are no signs of excess capacity buildup in actual monthly usage statistics. Overall, users indicated they are using their systems at about 73% of their total capacity, or 522 hours a month. The need for additional disk storage will be most pronounced among users of large systems: 74.2% of 3083 sites said they would need more DASD during 1986-87, compared with 71% of the larger sites.

Plug-compatible processor manufacturers Amdahl and NAS have lost another two percentage points off the value of their large-scale systems installed by respondents: their combined total is just over 11%, compared with just over 13% measured last year. Amdahl has the most, over 7%, down from just over 11% last year, while NAS has gone to 4% from just under 2% last year. Users of these companies' machines indicated, however, a declining disaffection with the vendors, particularly in the case of NAS: last year, 24% of the users running NAS gear said that when the time came they would switch their hardware for IBM's; this year, only 18% said so. Several measures of user attitudes toward their pcm vendors showed great improvement for Amdahl and NAS, while IBM lost

FIG. 3

IBM LESS AND LESS CHALLENGED IN MAINFRAME-RELATED DISK MARKET

RESPONDENT PLANS FOR NEXT 24 MONTHS' DISK UNIT PROCUREMENTS (ALL MODELS)

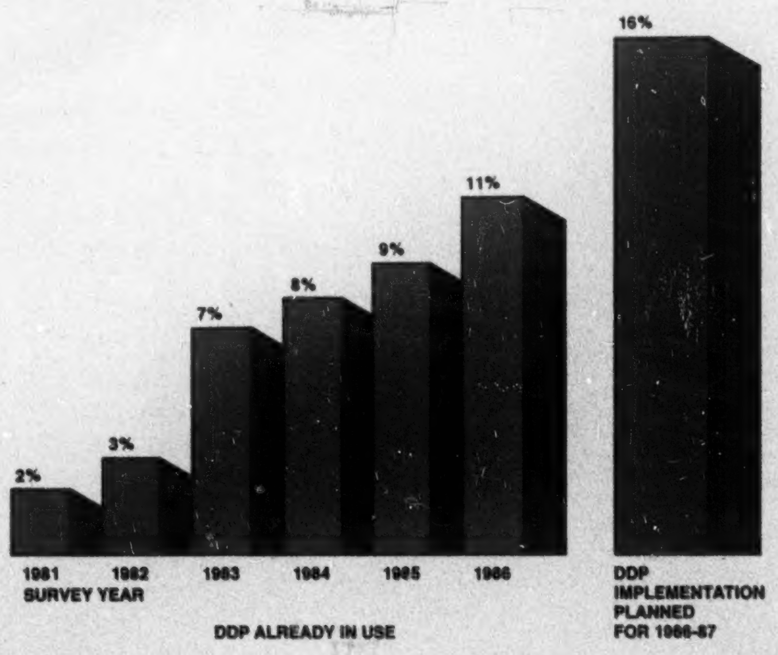


*2% National Advanced Systems

FIG. 4

IBM GAINS IN DISTRIBUTED DATA PROCESSING (DDP) AMONG BUNCH SITES

PERCENT OF SITES SPECIFYING IBM AS "PRINCIPAL" DDP SUPPLIER—BURROUGHS, HIS, SPERRY, NCR SAMPLES



favor with users compared with last year's survey, with the shift most adverse for IBM in the low- to mid-range of its line.

Users of the 575 Honeywell systems installed at respondent sites indicated plans to install an additional 281 machines from that vendor in the next two years. The majority of these will be Level 6 minicomputers. In general, users of Honeywell Level 6 and DPS 8 mainframes are not expecting any major mainframe announcements this year from the company, even as those machines approach the end of their product cycles.

Demand for additional system capacity at year-end is expected to be higher among large system sites than among small ones. Meanwhile, Honeywell's virtual memory GCOS 8 operating system is catching on with large systems users. In fact, 77% of small DPS 8/Level 66 survey respondents, 73% of large DPS 8/Level 66 respondents, and 89% of DPS 88 users expect to be converted to the operating system by the end of 1987. Some 78% of the DPS 88 respondents said they had already made the conversion.

As a percentage of their installed base's dollar value, the Honeywell respondents seemed subdued in their planned mainframe installation activity. While this survey two years ago showed them planning to acquire mainframe gear (excluding the DPS 6) worth 14% of their installed base, respondents this year expected to install only 10% in the coming 24 months. In terms of units, the outlook seemed a little brighter, with the installed base expected to grow by 15%, up from 13% in the previous two surveys. The subdued outlook is attributable to the limited takeoff of the DPS 88/90 mainframes and a winding down of the DPS 8 product cycle. It should be noted, too, that General Electric, a major Honeywell customer that installed DPS 88s at a heavy rate in 1985, is significantly underrepresented in this survey because of its corporate nondisclosure policy; had its numbers been included, the year-to-year picture would be worsened.

SOLID ADD-ON ACTIVITY

Add-on activity among Honeywell users looks solid, however. Almost 45% of the respondents planned to add disk drives, with Honeywell expected to garner about half of that business and plug-compatible manufacturers the other half. About 8% of the respondents planned to add tape drives, about 15% add-on memory, and 33% terminals. Honeywell, however, can look forward to getting only about half of that terminal business.

FIG. 5

DEC RESURGENCE IN TECHNICAL WORKSTATION AND MINICOMPUTER SECTORS

Query: Who is/will be your principal minicomputer and/or workstation supplier for these scientific/engineering applications?

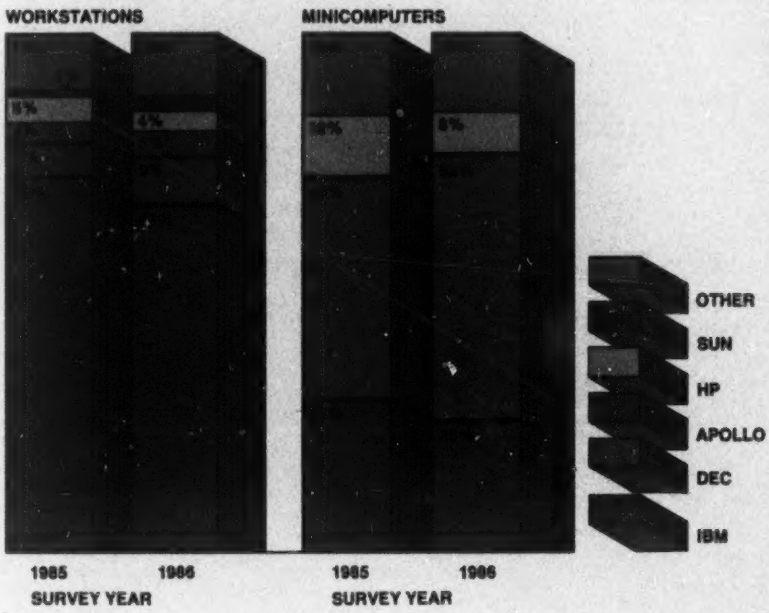
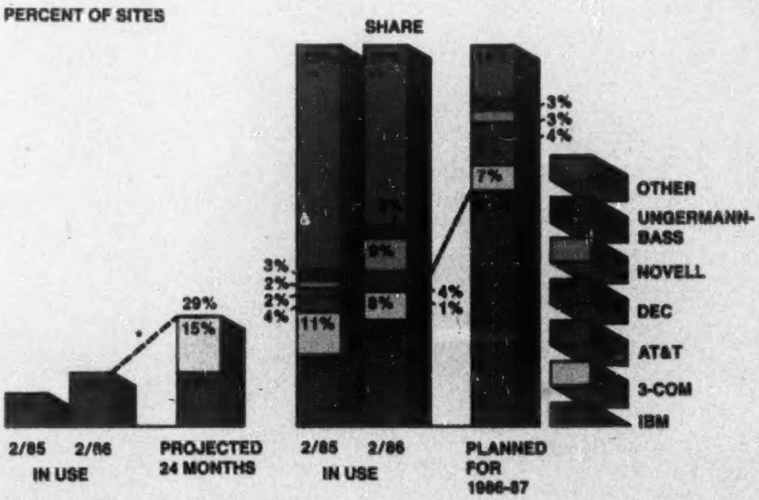


FIG. 6

RAPIDLY EMERGING IBM PRESENCE IN LAN MARKETPLACE

Query: If your organization has installed or plans to install a local area network (LAN), who is the supplier?



*44% compound user base expansion

**Includes Sytek (8% 2/85, 5% 2/86), Corvus/Omninet (8%, 4%), Xerox (4%, 3%), Wangnet (3%, 3%), Network Systems Hyperchannel (3%, 2%), etc.

Honeywell's long-term strategy for the past few years has been to use its DPS 6/Level 6 minicomputers as distributed processing adjuncts to its mainframes. The impact of the Level 6 machines has now leveled off. Among Level 64 mainframe sites, 44%—up from 43% in last year's survey—indicated they will use or are using the Honeywell minis. Among larger mainframe sites, this year's figure is 50%, down from 53% last year.

Like other mainframe companies, Honeywell has strived in the past few years to leverage off its large machines into the faster-growing office systems market. The company is showing modest but growing success with that strategy. Among users of medium- and large-scale mainframes, 27% —up from 20% last year—have installed or plan to install Honeywell's DPS 6 office automation systems. Another 16% said they planned to evaluate the Honeywell office gear.

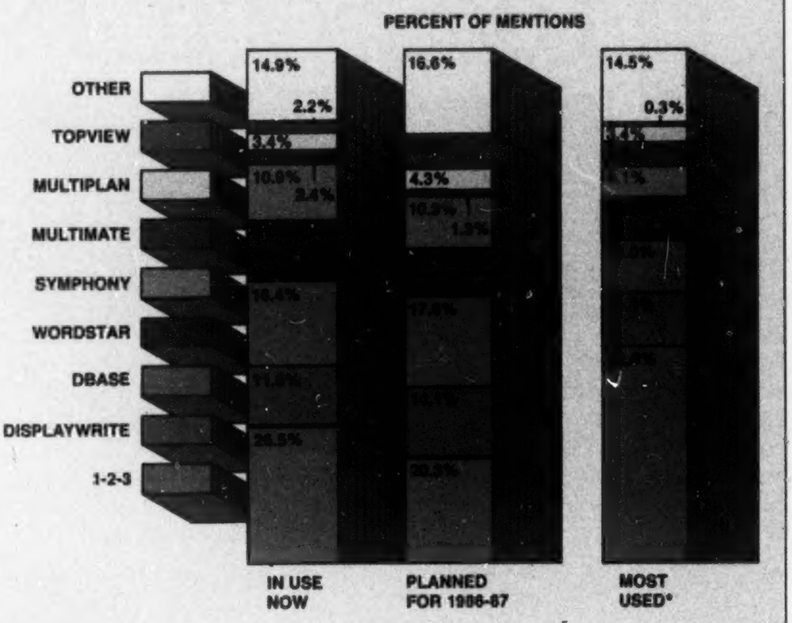
Users of Sperry systems showed mixed signs in this year's survey. The computer company seems to be doing well with its Sperrylink and personal computer lines, but at the mainframe end of the spectrum, spending plans are expected to be subdued. The firm's 1100/70 product is winding down and the 1100/90 cycle appears to have crested. As a result, Sperry sites indicated that, as a percentage of the value of their installed base, they would install gear worth 12% during the following 24 months. Last year's comparable figure was 19%. In terms of units, comparable percentages for the 1986 and 1985 surveys were 17% and 19%, respectively. Overall, the upgrade and add-on business potential seems most positive at the high end of Sperry's product line.

Sperry sites were asked to indicate if they planned to install additional processors on their mainframes during 1986. Among users of 1100/60s and /70s, 12% said they would add such gear; among 1100/80 sites, the figure was 13%; and among 1100/90 sites, the figure was 20%. As for peripherals, Sperry's outlook seemed less promising than that for other mainframe companies. While about 37% of the sites said they planned to add disk drives to their systems in 1986, Sperry would pick up only a little more than half that business. In the tape drive area, about 13% of the sites would add equipment, and Sperry would garner all but a fifth of that business. In add-on memory, 17% of the sites are planning activity, with Sperry looking to get about 90% of that business. Sperry will sell terminals to about 22% of its users this year, with another 4% buying from compatible vendors.

FIG. 7

PACKAGED PC SOFTWARE

Query: Which pc applications software packages does your organization use now or plan to use (initial or additionally) in 1986-87?

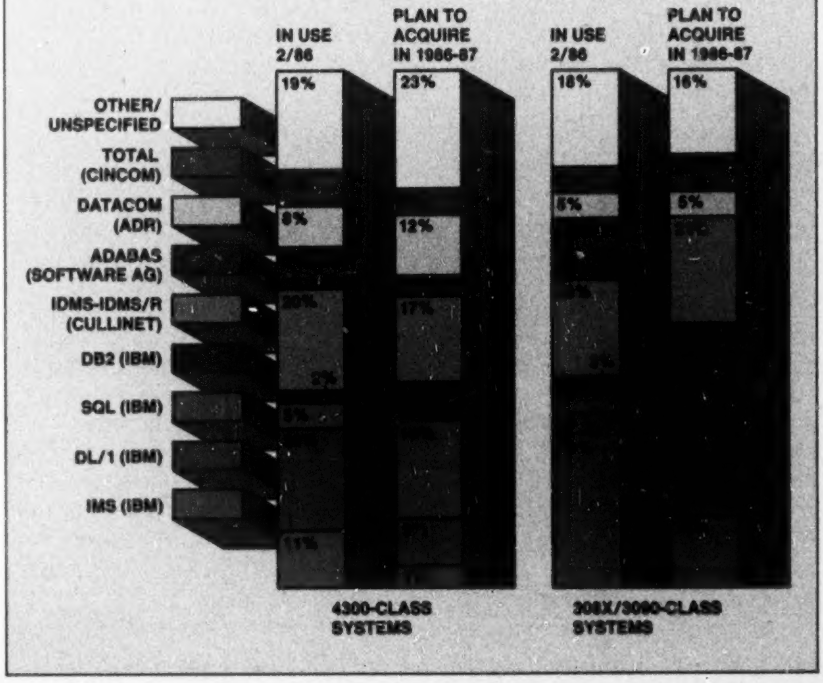


*Respondents asked to check two most used packages

FIG. 8

IBM'S DB2 DBMS TO MAKE GAINS

Query: If you are now using (or planning to use) a DBMS software package on your IBM or IBM-compatible mainframe system(s), which one(s)?



The need for extra capacity is expected to be greatest among sites using large-scale systems.

Sperry is finding good success with its Japanese-built, IBM-compatible personal computers within the confines of its mainframe user base. Asked if they had standardized (or plan to do so) on one or two personal computers, 54% of the Sperry sites said they had chosen Sperry machines and 23% said they had chosen IBM. Sperry pcs were hardly visible among IBM mainframe sites, however. As for Sperrylink, the company's office automation system, initial success at penetrating the mainframe base has been good, but it seems to be slowing. This year, 37% of the Sperry 1100 sites said they had already installed Sperrylink, up from 30% last year; but only 5% more indicated plans to install the system over the next two years.

UNIX HOT ISSUE FOR SPERRY

Another hot issue for Sperry has been its adoption of the Unix operating system. The company still seems to have its work cut out for it. To begin with, Sperry is not a major factor in its customer's minicomputer plans: even among technical/scientific sites, the firm is cited as "principal" mini supplier by only 13% of those responding. Among users of the 1100 series mainframes, only 13% termed Unix "very desirable" for those machines. The 1100/80 sites have adopted the AT&T operating system most, 11% planning to install it and 13% saying they have checked it out and may order it in the future. Only 4% of the 1100/90 sites have plans to install Unix.

Demand for additional equipment among NCR sites is spotty as customers wait for various new products to arrive. Among sites using NCR 8500 and 8600 series systems, many sites said they expect a model 9800 and a model 8800 to be introduced this year. Expected by smaller users are the 9500 and 9600 machines. Looking ahead to next year, the survey indicates that the heaviest demand for extra system capacity will come from large 8500/8600 sites.

Overall demand for NCR mainframe gear during the upcoming 24 months promises to be only moderate, reflecting the lack of any product cycle "driver." As a percentage of the installed base, planned installation activity will measure out at 14% in terms of dollar value and 22% in terms of units. Those numbers compare favorably with last year's 12% and 20%, respectively. (It should be noted that this survey does not take into account NCR's substantial foreign computer business, where the outlook may be more positive.) In three out of four categories, NCR will capture most of its customers' add-on business: more than half of their additional disk drives, all but a sixth or so of the tape drive business, and all but a small percent of their add-on memory acquisitions. Those three categories promise to be more active than was forecast in last year's survey. In terminals, however, overall business will be down, as will NCR's share of the total.

NCR has made good headway with its line of IBM PC-compatible desktop machines: of the NCR mainframe sites that have standardized on a particular brand of pc, 42% had chosen NCR, compared with 37% choosing IBM. However, even though NCR is trying hard to sell its Tower and 9000 line of minicomputer-class machines, 81% of the 8500/8600-class sites are choosing pcs as the vehicles for their small business systems applications. By the way, 48% of those using pcs in such applications are choosing NCR hardware.

In the office systems arena, NCR has made only modest penetration of even its own systems base. Among NCR sites, 10% had installed the firm's Worksaver product and 13% had chosen the Decisionmate; 2% of sites planned to install one of the two products, and 8% and 7%, respectively, planned to evaluate them.

EXPECT UNIX OS FROM NCR

NCR is considered likely to bring out a Unix operating system for its mainframe line. Asked if such an offering would make NCR systems more attractive for future expansion, 8% of responding sites said no and 35% said yes. Compared with last year's respective numbers of 8% and 38% and 1984's 4% and 44%, interest in Unix seems to be waning.

Attracted by new machines and a vendor that evidently has remedied some of its past failings, users of Burroughs equipment are planning to install much new equipment during the next 24 months. Their migration to the A series of mainframes is well under way, as is their acceptance of upgraded operating systems and Burroughs' Convergent Technologies-based workstations. And to the company's credit, this year's survey was the fifth in a row to show solid improvement in respondents' perception of Burroughs' field force.

Overall installation activity for 1986-87 promises to be fairly strong, owing largely to solid demand for large A and V series systems, but not as strong as the exceptional demand indicated in 1984. Measured as a percentage of their installed base, users indicated plans to install gear worth an extra 23% in dollars, compared with the 31% measured in 1984's survey and 15% in last year's survey. In terms of units, 19% more machines will be installed, compared to the 23% in 1985 and the 19% in 1984.

Add-on activity will be quite respectable. About 44% of responding sites said they would add disk drives, with Burroughs capturing more than half that business. About 13% would add tape drives and 13% would add memory, with Burroughs garnering the majority of those businesses, too. As for terminals, 29% of the sites will add hardware, and Burroughs will win just over half that business. Except for a slight dip in memory add-ons, each of those peripherals categories showed an increase over last year.

The survey revealed broad anticipation of as-then-unannounced new systems throughout the Burroughs product line. The strongest anticipation was found among large B7000-class sites, where 26% expected new hardware this year. Meanwhile, the survey revealed that by the end of 1986, roughly half the B6000/7000 sites will have completed the switch to the A series mainframes. At the time of the survey, 36% of former B6800/6900 users and 17% of former B7800/7900 users had already made such upgrades; of those that had not yet done so, 21% and 32%, respectively, said they would upgrade to the A machines this year. Asked if they have already upgraded their operating systems or plan to this year, A series users were most positive. For instance, among A-9 users, 7% said they will have Interpro 3.5 installed by 1987 and 71% said they will have MCP 3.6 A/S; among the A-15 users, the comparable figures were 16% and 64%.

Among the medium-scale users, response to the V series machines has been fairly good. An expected broadening of that product line should help accelerate migration. Among B3900/4800/4900 sites, 13% have already installed a V series mainframe, 13% plan to install one during 1986 and 11% plan to install one next year.

An increasingly large segment of Burroughs users are planning to use the firm's B25/28 products, which are based on Convergent Technologies designs. Already using or planning to use the small machines are 37% of B1000/A-3 sites, 42% of medium-scale sites, and 48% of large-system sites. Meanwhile, the firm's OMS II office system line is off to a more auspicious start than the ill-fated OFIS I line of a few years ago. At B6000/A-9 and B7000/A-15 sites, for instance, 2% and 6%, respectively, have the new gear installed, and another 9% and 12%, respectively, plan to install it. ●

To order the complete 1986 DATAMATION/Cowen & Co. mainframe survey results, priced at $850, please call Laurie Schnepf at (212) 605-9679.

C8650-1A

OEM EDITION JUNE 15 $3 TECHNICAL PUBLISHING

SPECIAL ISSUE

THE DATAMATION 100

DATAMATION

JUNE 15, 1986/$3 U.S.A.
VOLUME 32 NUMBER 12
This issue, 195,320 copies

FEATURES

24
BEHIND THE NEWS

Though they fight on, the BUNCH are finding that their PCM preeminence is "A Faded Glory." A DATAMATION staff report.

42
THE DATAMATION 100

The slump in the dp industry in 1985 may have been felt in profits, but it wasn't reflected in revenues. The top 100 worldwide computer companies raked in $150.8 billion last year, up 10% from 1984.

56
RANKING OF THE TOP 100

The 18 biggest dp companies of 1984 did it again in 1985. IBM's revenues were greater than its next 12 competitors combined. Sperry ironically beat out Burroughs for third place behind second-place DEC.

66
COMPANY PROFILES

Up close and personal with the top 100 dp firms—where they they're going, where they were, and how they got there.

160
MIXED FORECASTS FOR DP

Angeline Pantages

High technology has changed industries and organizations, but when it comes to productivity, the case is unproved.

169
NCC AT THE CROSSROADS

Robert B. Forest

Is NCC too big? Does it truly cover all the industry's bases? Is it up to date? Does it reflect the real world? Conference sponsors are facing these and other questions.

DEPARTMENTS

9 **LOOK AHEAD**
15 **LETTERS**
21 **HARDCOPY**
37 **WORLDWATCH**
177 **HARDWARE**
185 **SOFTWARE**
190 **MARKETPLACE**
190 **ADVERTISERS' INDEX**

OEM SUPPLEMENT 40-1

(DOES NOT APPEAR IN ALL EDITIONS)

-1 **FOREIGN AID**
-9 **WHAT PRICE PIRACY?**

COVER PHOTO BY PETER ANGELO SIMON

of all the companies in the DATAMATION 100. In fact, IBM's mainframe revenues alone were almost twice the size of second-place Digital Equipment Corp.'s total revenues.

Perhaps it is poetic justice that brought takeover target Sperry to one slot ahead of suitor Burroughs. In 1984, Burroughs had the third largest dp revenues, Sperry the seventh largest. Last year, inching past the company that at press time was attempting to take it over, Sperry sold $4.76 billion worth of dp goods, compared to Burroughs' $4.69 billion. To paraphrase Aretha Franklin, who's buyin' who? (see "A Faded Glory," p. 24).

Meanwhile, at the other end of the list, the company that just missed the cutoff for the DATAMATION 100 was Uccel Corp. Last year it ranked 89; this year it is first runner-up, landing at 101 with dp revenues of $204.8 million. Other companies that earned a rank in last year's 100 tumbled off this year's list, some edged out by new—particularly non-U.S.—entrants in the list, others because their sales slipped. Intel Corp., at 88 last year, is at 106 this year since its dp revenues grew only 4% to $187.2. British Petroleum Co. (Scicon), which had been at 90, is now at 103. The French firm CISI, which ranked 91 for 1984, slipped to 110 in '85. Other companies noticeable by their absence include Micom Systems, at 93 on last year's list and 104 on this year's; CPT Corp., dropping to 117 from 95; and Planning Research Corp., which moved to 102 from 99.

OTHERS THAT VANISHED

Other names have vanished from the list because they were bought by or merged with other companies. In the U.K., ICL, number 20 last year, vanished into conglomerate STC plc, number 24 this year. Dysan Corp., 81 on last year's list, is now a part of Xidex Corp., earning the new owner a rank of 69 on this year's list. Verbatim, 94 for 1984, was bought by Eastman Kodak Co., 97 in this year's ranking and a new entrant to the DATAMATION 100. Informatics General Corp. was at 83 until Sterling Software Corp. bought it out in the software industry's first hostile takeover; Sterling's purchase of Informatics also bought it a debut slot in this year's listing—number 88.

Some other companies that earned a rank in this year's list will probably be missing from next year's: among them, Volkswagen AG, number 56, which sold its biggest dp operation, Triumph Adler AG, to Olivetti, number 12; and Mitel Corp., number 76, which was bought by British Telecom plc, number 55.

FIG. 1

THE MARKETS OF THE DATAMATION 100

($ BILLIONS)

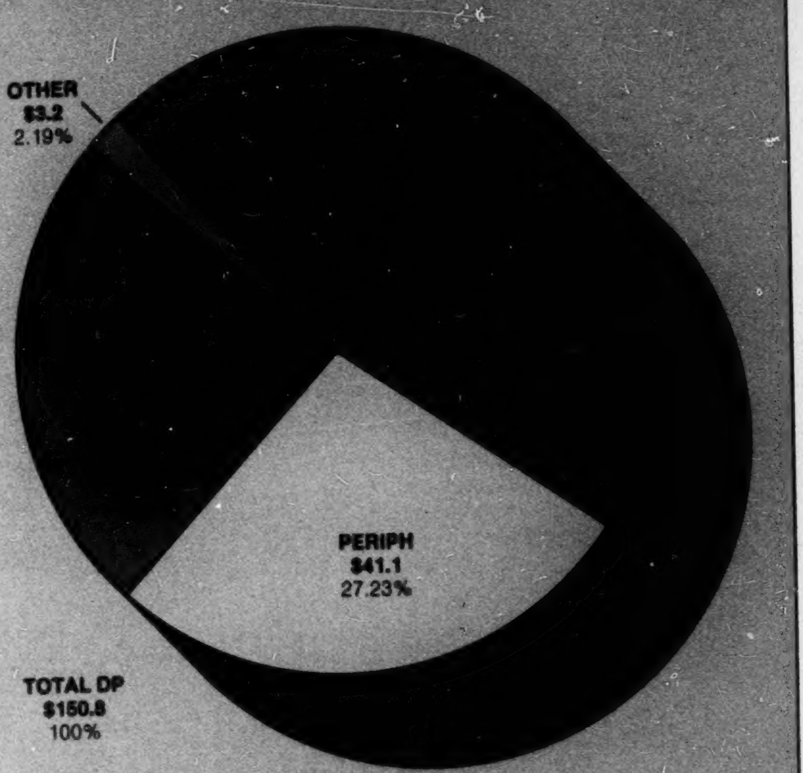


FIG. 2

THE TOP 15 COMPANIES IN MAINFRAMES

DTM 100 RANK	COMPANY	1985 ($ MIL.)	1984 ($ MIL.)	% CHANGE*
1	IBM	14,010.0	13,131.0	6.7
3	Sperry Corp.	1,890.8	1,451.1	30.3
5	Fujitsu Ltd.	1,618.6	1,535.5	5.4
7	NEC Corp.	1,216.6	1,076.6	13.0
8	Control Data Corp.	856.0	813.0	5.3
11	Hitachi Ltd.	836.8	745.3	12.3
15	Honeywell Inc.	775.0	665.0	16.5
4	Burroughs Corp.	747.3	747.3	NC
16	Groupe Bull	574.3	499.9	14.9
6	NCR Corp.	485.5	485.5	NC
35	Amdahl Corp.	434.0	400.0	8.5
10	Siemens Corp. AG	374.1	350.9	6.6
24	STC plc	370.0	362.9	2.0
62	Cray Research	332.6	200.0	66.3
46	National Semiconductor Corp.	300.0	250.0	20.0

*Percent change in dollars. In actual accounting currencies, Fujitsu's mainframe revenues were up 5.4% to ¥385.5 billion; NEC's were up 13% to ¥289.6 billion; Hitachi's were up 12.3% to ¥199.2 billion; Groupe Bull's were up 18% to FF5.1 billion; Siemen's were up 10% to DM1.1 billion; and STC plc's were up 6% to £288 million. NC: no change

FIG. 3

THE TOP 15 COMPANIES IN MINIS

DTM 100 RANK	COMPANY	1985 ($ MIL.)	1984 ($ MIL.)	% CHANGE*
1	**IBM**	3,500.0	3,500.0	NC
2	**Digital Equipment Corp.**	1,600.0	1,527.0	4.8
9	**Hewlett-Packard Co.**	1,050.0	950.0	10.5
13	**Wang Laboratories Inc.**	870.9	970.5	-10.3
28	**Data General Corp.**	799.7	840.0	-4.8
38	**Prime Computer Inc.**	563.7	479.1	17.7
48	**Tandem Computers Inc.**	533.1	477.1	11.7
36	**Harris Corp.**	470.0	410.0	14.6
5	**Fujitsu Ltd.**	439.0	383.9	14.4
23	**Nixdorf Computer AG**	407.9	340.0	20.0
3	**Sperry Corp.**	400.5	409.5	-2.2
4	**Burroughs Corp.**	400.0	400.0	NC
6	**NCR Corp.**	400.0	335.0	19.4
56	**Volkswagen AG**	366.7	314.0	16.8
12	**Ing. C. Olivetti & Co. S.P.A.**	348.6	394.9	-11.7

*Percent change in dollars. In actual accounting currencies, Fujitsu's mini revenues were up 14.3% to ¥104.5 billion; Nixdorf's were up 23.8% to DM1.1 billion; Volkswagen's were up 20.5% to DM 1.0 billion and Olivetti's were up 5.9% to L697.1 billion. NC: no change.

FIG. 4

THE TOP 15 COMPANIES IN MICROS

DTM 100 RANK	COMPANY	1985 ($ MIL.)	1984 ($ MIL.)	% CHANGE*
1	**IBM**	5,500.0	5,500.0	NC
17	**Apple Computer Corp.**	1,603.0	1,747.0	-8.2
12	**Ing. C. Olivetti & Co. S.P.A.**	884.5	496.9	78.0
27	**Tandy Corp.**	796.8	573.5	38.9
3	**Sperry Corp.**	742.8	503.4	47.6
41	**Commodore International Ltd.**	600.0	1,000.0	-40.0
52	**Compaq Computer Corp.**	503.9	329.0	53.2
9	**Hewlitt-Packard Corp.**	400.0	500.0	-20.0
60	**Convergent Technologies Inc.**	395.2	361.7	9.3
67	**Zenith Electronics Corp.**	352.0	249.0	41.4
7	**NEC Corp.**	338.6	305.1	11.0
74	**Apollo Computer Corp.**	295.6	215.9	36.9
20	**Matsushita Electronics Corp.**	270.6	278.4	-2.8
26	**LM Ericsson**	232.6	217.6	6.9
2	**Digital Equipment Corp.**	225.0	250.0	-10.0

*Percent change in dollars. In actual accounting currencies, Olivetti's micro revenues were up 113.6% to L1.7 trillion; NEC's were up 11% to ¥60.6 billion; Matsushita's were down 2.8% to ¥64.4 billion, and Ericsson's were up 11.1% to Skr2.0 billion. NC: no change.

There were some big movers on the chart—companies with a "bullet." One of them, newcomer Atlantic Computers plc, leapt to number 90 on revenues of $224.4 million; last year the U.K. leasing company was well off the list at number 127. Lotus Development Corp. moved up smartly from the bottom rung on last year's ladder; this year it is at the 89th position. Compaq proves as portable as its machines, moving up to 52 from 61; the year before last it had ranked 91.

Headed in the other direction, the notorious Storage Technology Corp. dropped to 45 from 34, down from 15 the year before last. Computervision Corp. skidded to 57 from 46, dropping below its big CAD/CAM competitor, Intergraph Corp., which rose slightly to 51 from 52.

The ebbing micro wave hurt several companies, particularly some that had hitched their stars too tightly to supplying parts to IBM. Disk drive specialist Seagate—which lost almost half of its IBM business—fell to 95 from 62. Another participant in the dangerous disk drive business also lost big last year: Tandon Corp. dropped to 81 from 53.

The top 15 microcomputer makers had mixed results. While their total market in 1985 was up a slim 4.6% over 1984—to $13.1 billion from $12.5 billion—the wealth was not evenly shared. DATMATION estimates that although IBM's micro revenues were flat, they held at a huge $5.5 billion for the year. Apple, on the other hand, lost ground, with micro revenues off about 8%. (Reorganization should help this pc pioneer in 1986, however: cost-cutting has raised its revenue per employee to $419,300, the highest in the survey for companies whose revenues are 100% dp related.) A big winner was Olivetti, its micro revenues up more than 113% when measured in the company's actual accounting currency. Tandy also did well, its Model 1000 PC clone scoring on both price and features to lead the big retailer to a 38.9% increase in micro revenues, up to $796.8 million from 1984's $573.5 million. As noted, Compaq continued to soar, with its micro revenues skyrocketing 53.2% to a robust $503.9 million in this year's listing from $329 million in last year's survey.

The biggest loser in micro revenues last year was troubled Commodore. With its early mainstays aging, and with, at best, mixed response to its Amiga pc, revenues were off a huge $400 million. Once a billion-dollar corporation, last year the company did $600 million in micro sales.

In the minicomputer market—including superminis—sales of the top 15 companies were up slightly, rising 4.3% to

$12.2 billion from 1984's $11.7 billion. And while people are heard saying that "DEC is eating IBM's lunch in minis," Big Blue still takes the cake, having sold $3.5 billion worth last year. Nevertheless, IBM's sales were flat in this market, while DEC's mini sales rose a bit more than the market, up 4.8% to $1.6 billion from $1.52 billion. The biggest loser in the top 15 was Wang, off 10.3% to $870.9 million from 1984's $970 million. Reflecting currency swings, Olivetti's mini sales were up 5.9% measured in its actual accounting currency, but down 11.7% when calculated in dollars.

Few surprises are revealed in the top 15 makers of mainframes—including supercomputers. IBM takes the top, up 6.7% over 1984's $13.1 billion, selling $14 billion in 1985. IBM alone did more than 56% of the total mainframe business booked by the top 15 companies in the market. The mainframe market was perhaps the healthiest in the entire dp business: among the top 15, no company's mainframe revenues fell, and only one remained flat, Burroughs at $747.3 million. Supercomputer maker Cray had the largest percentage increase in sales in this market, rising 66.3% to $332.6 million from 1984's $200 million. Of course, at the prices it charges, Cray can improve revenues exponentially by selling just a few more machines.

The biggest revenue producer in the dp market of the DATAMATION 100 companies is, not surprisingly, peripherals and supplies. Just over $41 billion, more than a quarter of the total dp pie, ended up on the plates of peripherals sellers. No surprises in who took the lion's share: IBM grabbed $12.6 billion in peripherals sales, up 8.8% from its 1984 performance. DEC took second place in this market, with $2.7 billion. More than a third of the top 15 peripherals marketers in the DATAMATION 100 were non-U.S. companies, among them the biggest growers, Toshiba, up 45.6% to $759 million, and Hitachi, up 35.1%. The Japanese share of the disk drive, printer, and facsimile markets in particular had strong growth.

FEW ALL-SOFTWARE COMPANIES

"Pure" software companies were again conspicuous by their rarity on the list, with only two making appearances, Lotus Development and Sterling Software. In the services area, there was no change at all from last year's list in the top seven slots. Longtime leader Automatic Data Processing held on to the top spot, trailed by Control Data, GM's EDS, General Electric, Computer Sciences, McDonnell Douglas, and Martin Marietta.

FIG. 5

THE TOP 15 COMPANIES IN PERIPHERALS

DTM 100 RANK	COMPANY	1985 ($ MIL.)	1984 ($ MIL.)	% CHANGE*
1	**IBM**	12,676.0	11,652.0	8.8
2	**Digital Equipment Corp.**	2,750.0	2,500.0	10.0
4	**Burroughs Corp.**	1,479.0	1,412.0	4.7
14	**Xerox Corp.**	1,430.0	1,180.0	21.2
11	**Hitachi Ltd.**	1,416.7	1,049.0	35.1
8	**Control Data Corp.**	1,270.0	1,314.5	-3.4
13	**Wang Laboratories Inc.**	1,229.5	1,100.6	11.7
9	**Hewlett-Packard Corp.**	1,100.0	900.0	22.2
5	**Fujitsu Ltd.**	1,064.3	932.1	14.2
7	**NEC Corp.**	1,053.3	882.3	19.4
6	**NCR Corp.**	1,000.0	950.0	5.3
10	**Siemens AG**	816.2	701.8	16.3
21	**Toshiba Corp.**	759.5	521.7	45.6
16	**Groupe Bull**	699.1	605.9	15.4
15	**Honeywell Inc.**	656.0	600.0	9.3

*Percent change in dollars. In actual accounting currencies, Hitachi's peripherals revenues were up 35.1% to ¥337.3 billion; Fujitsu's were up 14.2% to ¥253.4 billion; NEC's were up 19.4% to ¥250.7 billion; Siemens' were up 20% to DM2.4 billion; Toshiba's were up 45.6% to ¥180.8 billion; and Groupe Bull's were up 18.5% to FF6.2 billion.

FIG. 6

THE TOP 15 COMPANIES IN COMPUTER SERVICES

DTM 100 RANK	COMPANY	1985 ($ MIL.)	1984 ($ MIL.)	% CHANGE*
31	**Automatic Data Processing Inc.**	1,102.1	959.4	14.9
8	**Control Data Corp.**	1,058.7	930.5	13.8
32	**General Motors Corp.**	978.3	786.1	24.4
29	**General Electric Co.**	950.0	825.0	15.2
37	**Computer Sciences Corp.**	800.7	709.6	12.8
30	**McDonnell Douglas Corp.**	650.0	608.0	6.9
58	**Martin Marietta Corp.**	429.9	361.5	18.9
39	**Nippon Telegraph and Telephone Corp.**	382.0	375.0	1.9
3	**Sperry Corp.**	302.5	288.6	4.8
6	**NCR Corp.**	300.0	285.0	5.3
1	**IBM**	300.0	200.0	50.0
79	**Boeing Corp.**	270.0	260.0	3.8
14	**Xerox Corp.**	200.0	180.0	11.1
96	**General Instrument Corp.**	190.2	193.4	-1.7
99	**Quotron Systems Inc.**	187.5	189.9	-1.3

*Percent change in dollars. In actual accounting currencies, Nippon Telegraph and Telephone's computer services revenues were up 1.9% to ¥90.9 billion.

A conspicuous new entry is the deregulated Japanese telecom giant, Nippon Telegraph and Telephone, with services revenues of $382 million (¥90.9 billion).

Bucking the overall upward trend outside the U.S. was Thorn EMI, down 38.5% in actual accounting currency; in dollars, the company declined to $205 million from $346.7 million. Other Asian and European companies on the list whose dp revenues fell were Japan's Sony and the U.K.'s Plessey and Racal. Much of Racal's grief is attributed to unhappy results from its U.S. operations.

Several U.S. companies—including IBM—said in their annual reports for 1985 that good international business had eased the sting of bad news at home. It is expected that the falling value of the dollar will make foreign markets even more attractive for U.S. vendors in 1986.

A recent study of the total European dp market for 1985 showed that it was up an estimated 16%. And in Japan, IBM Japan's share of the local market for mainframes, for example, was over 30% compared to homegrown Fujitsu's 28.7%. Manufacturing by American companies has also found a happy home in Japan, where more than half the production value of both the top and bottom of IBM's line—the Sierra and the PC—originates.

The largest European company on this year's list held that honor last year: Siemens again took 10th place with dollar dp sales of $3.2 billion, up 17% from 1984's $2.8 billion. (In actual accounting currency, Siemens was up 20.8%, to DM9.6 billion from DM7.9 billion.) Next was Olivetti, also up nicely, rising 18.7% to $2.5 billion. (Reflecting the dollar's strength during the year, Olivetti's sales were up even more in lira, rising 42.5% to L5.04 trillion from 1984's L3.5 trillion.)

The largest Asian company, with the fifth highest dp sales in the industry, was Fujitsu. While dp revenues for this plug-compatible specialist rose about 12%, profits for the corporation as a whole were dismal, dropping 32.9% in actual accounting currency. Most of the growth of Japanese dp companies last year came within their domestic market, with dp exports rising only 1.6%. On the other hand, analysts at the U.S. Embassy in Tokyo have told DATAMATION that Japanese imports of dp ware were up substantially, rising 31% to $1.2 billion in 1985. Since this does not include the sizable sales of U.S.-owned Japanese-based subsidiaries, the U.S. payoff from Japanese operations is impressive.

Not on this year's list, but poised to appear on next year's, are the Korean companies, Daewoo in particular. With the val-

FIG. 7

THE TOP 10 MONEY MAKERS

DTM 100 RANK	COMPANY	1985 % NET RETURN ON SALES	1984 % NET RETURN ON SALES
62	Cray Research Inc.	20	20
89	Lotus Development Corp.	17	23
54	Comdisco Inc.	15	5
55	British Telecom plc	13	13
1	IBM	13	14
51	Intergraph Corp.	13	16
72	Shared Medical Systems Corp.	13	13
99	Quotron Systems Inc.	11	14
98	Gerber Scientific Inc.	10	11
49	Telex Corp.	10	9

FIG. 8

GROWTH SPURTS

Companies ranked by % change in dp revenue

DTM 100 RANK	COMPANY	% CHANGE*	1985 DP REVS. ($ MIL.)	1984 DP REVS. ($ MIL.)
90	Atlantic Computers plc	87.0	224.0	120.0
69	Xidex Corp.	75.0	342.0	195.4
62	Cray Research Inc.	66.1	380.2	228.8
52	Compaq Computer Co.	53.1	503.9	329.0
89	Lotus Development Corp.	43.7	225.5	159.9
67	Zenith Electronics Corp.	41.3	352.0	249.0
74	Apollo Computer Inc.	36.9	295.6	215.9
82	NBI Inc.	36.4	260.7	191.1
47	Ricoh Co. Ltd.	35.2	634.7	469.2
49	Telex Corp.	34.9	597.4	442.7

*Percent change in dollars. In actual accounting currencies, Atlantic's revenues were up 94.4%; Ricoh's were up 35.3%.

FIG. 9

DIRTY DOZEN

Top 12 money losers

DTM 100 RANK	COMPANY	1985 NET LOSS ($ MIL.)
8	Control Data Corp.	567.5
41	Commodore International Ltd.	237.2
80	Gould Inc.	175.7
81	Tandon Corp.	135.4
42	Texas Instruments Inc.	118.7
96	General Instrument Corp.	106.7
46	National Semiconductor Corp.	89.5
57	Computervision Corp.	80.8
24	STC plc	69.0*
13	Wang Laboratories Inc.	63.3
59	Datapoint Corp.	62.1
45	Storage Technology Corp.	57.4

*In actual accounting currency, STC plc lost £53.8 million.

ue of Korean currency tied directly to that of the U.S. dollar, the strengthening yen means that the trend toward Korean manufacture will continue. For example, the successful PC clone sold in the U.S. by Leading Edge used to be built by Japan's Mitsubishi; now Daewoo does it.

While 11 of the 12 "biggest losers," the companies with the greatest net losses for the year, were U.S. companies, two non-U.S. companies on this year's list also ended up in the red: the U.K.'s STC plc lost $69 million (£53.8 million in actual accounting currency), and Canada's Mitel lost $23.1 million (C$31.6 million in actual accounting currency). Control Data's well-publicized troubles gave it top "honors" in this gloomy category, as more than half a billion dollars were written in red ink. The biggest loser on last year's chart, Storage Technology, while still in the minus column for 1985, did make some money in its fourth quarter: it lost $57.6 million for 1985, much improved from the $505.5 million it had lost in 1984. Ceo Ryal Poppa has predicted the company will leave the minus column for good in 1986.

METHODOLOGY

Throughout the year, DATMATION observes over 200 companies on a worldwide basis. The survey is meant to be used as a comparative analysis, and therefore all revenues and earnings figures have been adjusted to calendar-year calculations. Because over half the companies covered operate on a fiscal year that does not coincide with the calendar year, their revenues and earnings for purposes of this survey have been derived from quarterly reports and our best estimates. DATAMATION has listed total net income in all cases, not income from continuing operations. Numbers relating to research and development expenditures and total number of employees, however, are reported as of each company's most recent fiscal year-end.

During 1985, a number of DATAMATION 100 companies restated their year-earlier performance figures, whether to reflect changed accounting methods, mergers, spin-offs, or just plain errors in earlier reports. Each chart and table within the survey incorporates the restated numbers. On the main chart of the DATAMATION 100, however, each company's relative position is as it was published last year.

Also, note that a company's internal sales made to other divisions or units within the company are excluded from the year's total data processing revenues, as they are considered captive and not commercial sales.

For purposes of the survey, dp-re-

FIG. 10

HEARTY WORKERS

The top companies by dp revenue per employee

DTM 100 RANK	COMPANY	REVS. PER EMPL. ($ THOU.)	1985 DP REVS. ($ MIL.)	1985 EMPLS.
17	Apple Computer Corp.	419.3	1,753.8	4,182
52	Compaq Computer Corp.	270.9	503.9	1,860
60	Convergent Technologies Inc.	198.3	395.2	1,992
50	Nippon Univac Kaisha Ltd.	129.9	552.9	4,254
94	Centronics Data Computer Corp.	127.1	216.2	1,700
35	Amdahl Corp.	123.1	862.0	7,000
99	Quotron Systems Inc.	120.9	205.7	1.701
1	IBM	119.7*	48,554.0	405,535
62	Cray Research Inc.	119.5	380.2	3,180
48	Tandem Computer Inc.	115.5	634.6	5,494
51	Intergraph Corp.	103.9	526.4	5,065
38	Prime Computer Inc.	94.8	769.7	8,115

Because IBM receives an estimated 3.1% of its total revenues from nondp business, its dp productivity is assumed to be slightly higher. The other companies on the chart derive 100% of their total revenues from dp.

FIG. 11

THE 10 WHO HIRED THE MOST

DTM 100 RANK	COMPANY	1985 EMPLS.	1984 EMPLS.	% CHANGE
95	Seagate Technology	5,700	3,700	54.1
62	Cray Research Inc.	3,180	2,203	44.3
52	Compaq Corp.	1,860	1,400	32.9
47	Ricoh Co. Ltd.	25,000	20,000	25.0
24	STC plc	51,600	43,200	19.4
72	Shared Medical Systems Corp.	3,300	2,800	17.9
60	Convergent Technologies Inc.	1,992	1,700	17.2
37	Computer Sciences Corp.	15,600	13,400	16.4
87	Cap Gemini Sogeti	5,200	4,500	15.6
23	Nixdorf Computer AG	23,290	20,190	15.4

FIG. 12

THE 10 WHO FIRED THE MOST

DTM 100 RANK	COMPANY	1985 EMPLS.	1984 EMPLS.	% CHANGE
63	Dataproducts Corp.	4,100	5,800	-29.3
59	Datapoint Corp.	5,993	8,431	-28.9
57	Computervision Corp.	4,770	6,500	-26.6
17	Apple Computer Corp.	4,182	5,382	-22.3
8	Control Data Corp.	44,300	54,100	-18.1
3	Sperry Corp.	67,000	77,000	-12.9
81	Tandon Corp.	3,100	3,500	-11.4
46	National Semiconductor Corp.	37,100	41,700	-11.0
42	Texas Instruments Inc.	77,872	86,563	-10.0
44	Motorola Inc.	90,200	99,900	-9.7

lated revenue is defined as general purpose dp products and services generated by one or more of the following categories of equipment: mainframes, minicomputers, microcomputers, office systems, data communications, peripherals and terminals, software and services, and maintenance and repair. Explicitly excluded are data transmission or "basic" services revenues from specialized common carriers; standalone electronic and mag card typewriters and standalone electronic cash registers; instrumentation; semiconductors; printed circuit boards; automatic test equipment; and dp supplies, with the exception of magnetic media for disk and tape drives. All peripherals that attach to a system are included. For computer-based manufacturing systems, such as computer-controlled machine tools, only the computer and hardcopy output devices are included and not the tools themselves.

In cases where a company has not explicitly stated dp revenues, DATAMATION has estimated the figures based on investigative reporting and observation of industry trends.

In other cases, where companies did not cöoperate fully with the survey, it was necessary to estimate performance of particular product segments that produced revenues. In some instances, particularly maintenance and repair, and software sales by large hardware manufacturers who will not separate software revenues from system sales, the market segmentation is either the company's own breakdown or DATAMATION's best estimate.

To calculate the dollar value of the results of non-U.S. companies, OECD average exchange rates were used. For calendar 1985, the equivalents to one dollar in these currencies were the following: Canada, C$1.37; Finland, MK6.20; France, FF8.98; Italy, L1,909.4; Japan, ¥238.62; the Netherlands, G3.32; Norway, NOK8.59; Sweden, Skr8.6; the U.K., £.78; and West Germany, DM2.94;

For calendar 1984, the equivalents to one dollar were Canada, C$1.28; Finland, MK6.0; France, FF8.74; Italy, L1,757.0; Japan, ¥237.55; the Netherlands, G3.21; Norway, NOK8.16; Sweden, Skr8.27; the U.K., £.75; and West Germany, DM2.85. ◉

Reprints of the DATAMATION 100 survey, including individual profiles, are available in quantities of 100 or more. Details may be obtained by telephoning Cindy Lam at (212) 605-9730 or by writing to DATAMATION, 875 Third Ave., New York, NY 10022.

FIG. 13

BEYOND THE DOLLAR

(Ranked by % change in dp revenues in actual accounting currency.)

DTM 1985 RANK	COMPANY	AAC % CHNG.	1985 DP REVS. AAC (MIL.)	1984 DP REVS. AAC (MIL.)	COUNTRY
90	Atlantic Computers	94.4	£175.0	90.0	U.K.
12	Ing. C. Olivetti & Co. S.P.A.	42.4	L5,036,500.0	3,535,700.0	Italy
92	Norsk Data AS	38.8	NOK1,888.0	1360.0	Norway
47	Ricoh Co. Ltd.	35.3	¥151,118.0	111,719.8	Japan
21	Toshiba Corp.	30.1	¥335,483.4	257,910.0	Japan
20	Matsushita Elec. Indust. Co.	30.0	¥344,662.7	265,105.8	Japan
93	Nokia Corp.	24.2	MK1,349.0	1,086.0	Finl.
65	BASF	23.5	DM1,050.0	850.0	W. Ger.
87	Cap Gemini Sogeti	22.2	F2,200.0	1,800.0	France
10	Siemens AG	20.8	DM9,600.0	7,950.0	W. Ger.
39	Nippon Telegraph and Telephone	20.8	¥181,923.9	150,582.9	Japan
23	Nixdorf Computer AG	20.5	DM3.939.6	3,270.0	W. Ger.
56	Volkswagen	19.7	DM1,331.7	1,112	W. Ger.
16	Groupe Bull	18.5	F16,109.0	13,596.0	France
43	C. Itoh & Co. Ltd.	14.6	¥168,251.0	146,782.0	Japan
7	NEC Corp.	14.1	¥895,660.2	785,317.0	Japan
26	LM Ericsson	14.1	Skr10,600.0	9,290.0	Sweden
22	N.V. Philips	13.4	G4,534.0	4,000.0	Neth.
25	Northern Telecom Ltd.	13.3	C$1,700.0	1,500.0	Canada
33	Mitsubishi Electric Corp.	13.3	¥222,210.0	196,160.0	Japan
11	Hitachi Ltd.	12.6	¥687,000.0	610,000.0	Japan
5	Fujitsu Ltd.	12.3	¥1,026,066.0	913,973.6	Japan
50	Nippon Univac Kaisha Ltd.	11.5	¥131,646.7	118,062.4	Japan
53	Compagnie Générale d'Electricité	10.3	F4,300.0	3,900.0	France
77	Ferranti plc	10.3	£220.0	199.5	U.K.
24	STC plc	10.0	£1,038.0	£944.0	U.K.
76	Mitel Corp.	8.9	C$403.9	371.0	Canada
66	Mannesmann Kienzle GmbH	7.0	DM1,046.0	977.6	W. Ger.
34	Oki Electric Industry Co. Ltd.	4.0	¥211,990.0	203,770.4	Japan
55	British Telecom plc	0.0	£355.0	0.0	U.K.
86	Plessey Co. plc	-10.3	£195.0	217.5	U.K.
91	Sony Corp.	-10.3	¥52,806.6	58,888.6	Japan
61	Racal Electronics plc	-14.4	£297.0	347.0	U.K.
100	Thorn EMI	-38.5	£159.9	260.0	U.K.

THE DATAMATION 100

THE LEADING WORLDWIDE DP COMPANIES

1985 RANK	1984 RANK	COMPANY	1985 TOTAL REVENUE	1985 DP REVENUE	1984 DP REVENUE	DP REV % CHG
1	1	**International Business Machines**	$50,056.0	$48,554.0	$44,292.0	9.6
2	2	**Digital Equipment Corp.**	7,029.4	7,029.4	6,230.0	12.8
3	7	**Sperry Corp.**	5,526.8	4,755.1	4,015.0	18.4
4	3	**Burroughs Corp.**	5,037.7	4,685.3	4,500.0	4.1
5	6	**Fujitsu Ltd.**	6,563.0	4,309.5	3,838.7	12.3
6	5	**NCR Corp.**	4,317.2	3,885.5	3,670.0	5.9
7	9	**NEC Corp.**	9,899.4	3,761.8	3,298.3	14.1
8	4	**Control Data Corp.**	3,679.7	3,679.7	3,692.6	-0.3
9	8	**Hewlett-Packard Co.**	6,505.0	3,675.0	3,400.0	8.1
10	10	**Siemens AG**	18,574.9	3,265.0	2,789.7	17.0
11	12	**Hitachi Ltd.**	20,919.4	2,885.4	2,562.0	12.6
12	13	**Ing. C. Olivetti & Co. S.P.A.**	3,070.2	2,518.2	2,121.4	18.7
13	11	**Wang Laboratories Inc.**	2,428.3	2,428.3	2,421.3	0.3
14	17	**Xerox Corp.**	8,732.1	1,959.0	1,718.2	14.0
15	15	**Honeywell Inc.**	6,624.6	1,951.9	1,825.3	6.9
16	16	**Groupe Bull**	1,794.5	1,794.5	1,555.4	15.4
17	14	**Apple Computer Corp.**	1,753.8	1,753.8	1,897.9	-7.6
18	18	**AT&T Co.**	34,910.0	1,500.0	1,340.0	11.9
19	25	**TRW Inc.**	5,917.2	1,450.0	1,105.0	31.2
20	—	**Matsushita Electric Indust. Co. Ltd.**	21,221.4	1,447.6	1,113.4	30.0
21	22	**Toshiba Corp.**	14,377.9	1,409.0	1,083.2	30.1
22	26	**N.V. Philips Gloeilampenfabrieken**	18,085.6	1,365.6	1,246.0	9.6
23	21	**Nixdorf Computer AG**	1,339.9	1,339.9	1,147.4	16.8
24	20	**STC plc**	2,560.6	1,330.8	1,258.6	5.7
25	27	**Northern Telecom Ltd.**	4,246.9	1,240.8	1,170.0	6.1
26	24	**LM Ericsson**	3,779.3	1,232.8	1,123.2	9.8
27	38	**Tandy Corp.**	3,126.3	1,200.0	932.6	28.7
28	19	**Data General Corp.**	1,199.7	1,199.7	1,254.5	-4.4
29	31	**General Electric Co.**	28,285.0	1,130.0	945.0	19.6
30	28	**McDonnell Douglas Corp.**	11,477.7	1,104.5	982.8	12.4
31	29	**Automatic Data Processing Inc.**	1,102.1	1,102.1	959.4	14.9
32	35	**General Motors Corp.**	96,371.7	978.3	786.1	24.4
33	33	**Mitsubishi Electric Corp.**	8,484.4	933.3	823.9	13.3
34	30	**Oki Electric Industry Co. Ltd.**	1,680.0	890.4	855.8	4.0
35	36	**Amdahl Corp.**	862.0	862.0	779.4	10.6
36	37	**Harris Corp.**	2,306.6	810.0	730.0	11.0
37	39	**Computer Sciences Corp.**	800.7	800.7	709.6	12.8
38	40	**Prime Computer Inc.**	769.7	769.7	642.8	19.7
39	—	**Nippon Telegraph and Telephone Corp.**	20,651.4	764.1	632.4	20.8
40	41	**ITT Corp.**	20,007.0	756.0	640.0	18.1
41	23	**Commodore International Ltd.**	798.6	750.0	1,150.0	-34.8
41	32	**Texas Instruments Inc.**	4,924.5	750.0	860.0	-12.8
43	49	**C. Itoh & Co. Ltd.**	61,435.1	706.7	616.5	14.6
44	43	**Motorola Inc.**	5,443.0	704.0	618.0	13.9
45	34	**Storage Technology Corp.**	673.4	673.4	808.6	-16.7
46	47	**National Semiconductor Corp.**	1,605.9	650.0	550.0	18.2
47	65	**Ricoh Co. Ltd.**	2,441.2	634.7	469.2	35.3
48	45	**Tandem Computers Inc.**	634.6	634.6	565.9	12.1
49	50	**Telex Corp.**	683.1	597.4	442.7	34.9
50	—	**Nippon Univac Kaisha Ltd.**	552.9	552.9	495.9	11.5

All dollar figures are in millions. NA: not available

	NONDOLLAR ACCTG CURRENCY					R&D			
DP AS % OF TOT	1985 DP	1984 DP	% CHG	CNTRY	1985 EMPL	CORP 1985	AS % OF TOT REV	NET INCOME	FISCAL YEAR END
97					405,535	$4,723.0	9.4	$6,555.0	Dec.
100					91,000	770.0	10.9	400.6	June
86					67,000	504.9	9.1	37.4	March
93					60,500	285.2	5.7	248.2	Dec.
66	¥1,026,066.0	913,973.6	12.3	Japan	74,137	524.5	9.9	235.2	March
90					62,000	299.1	6.9	315.2	Dec.
38	¥895,660.2	785,317.0	14.1	Japan	90,102	1,258.8	12.7	249.9	March
100					44,300	438.3	11.9	-567.5	Dec.
56					84,000	685.0	10.5	489.0	Oct.
18	DM9,600.0	7,950.0	20.8	W. Ger.	348,000	1,632.5	8.8	519.7	Sept.
14	¥687,000.0	610,000.0	12.6	Japan	164,951	1,223.9	5.9	768.6	March
82	L5,036,500.0	3,535,700.0	42.4	Italy	48,944	142.0	4.6	250.0	Dec.
100					31,000	187.0	7.7	-63.3	June
22					102,396	603.1	6.9	475.0	Dec.
29					94,022	451.4	6.8	281.6	Dec.
100	FF16,109.0	13,596.0	18.5	France	26,403	182.3	10.2	12.3	Dec.
100					4,182	72.5	4.1	72.0	Sept.
4					337,600	2,209.7	6.3	1,557.0	Dec.
25					82,446	254.9	4.3	-7.1	Dec.
7	¥344,662.7	265,105.8	30.0	Japan	133,963	1,011.0	4.8	1,035.1	Nov.
10	¥335,483.4	257,910.0	30.1	Japan	114,000	862.7	6.0	326.5	March
8	G4,534.0	4,000.0	13.4	Neth.	345,600	1,208.1	6.6	276.8	Dec.
100	DM3,939.6	3,270.0	20.5	W. Ger.	23,290	130.9	9.8	NA	Dec.
52	£1,038.0	944.0	10.0	U.K.	51,600	196.8	7.7	-69.0	Dec.
29	C$1,700.0	1,500.0	13.3	Canada	46,549	427.9	10.1	275.0	Dec.
33	Skr10,600.0	9,290.0	14.1	Sweden	78,000	325.4	8.6	38.7	Dec.
38					35,000	NA	NA	203.9	June
100					16,535	128.4	10.7	24.3	Sept.
4					304,000	NA	NA	2,336.0	Dec.
10					97,067	NA	NA	345.7	Dec.
100					18,500	42.0	3.8	95.3	June
1					811,000	NA	NA	3,999.0	Dec.
11	¥222,210.0	196,160.0	13.3	Japan	68,745	339.4	4.0	169.1	March
53	¥211,990.0	203,770.4	4.0	Japan	18,134	NA	NA	19.0	March
100					7,000	134.8	15.9	28.7	Dec.
35					31,400	116.0	5.0	60.7	June
100					15,600	NA	NA	22.3	March
100					8,115	81.8	10.6	57.8	Dec.
4	¥181,923.9	150,582.9	20.8	Japan	314,000	534.9	2.6	1,375.9	March
4					232,000	1,100.0	5.5	293.5	Dec.
94					NA	46.5	NA	-237.2	June
15					77,872	769.0	15.6	-118.7	Dec.
1	¥168,251.0	146,782.0	14.6	Japan	NA	NA	NA	NA	March
13					90,200	464.0	8.5	72.0	Dec.
100					NA	65.5	9.7	-57.4	Dec.
40					37,100	204.6	12.7	-89.5	May
26	¥151,118.0	111,719.8	35.3	Japan	25,000	122.1	5.0	74.4	March
100					5,494	71.6	11.3	31.9	Sept.
87					6,370	34.3	9.1	67.0	March
100	¥131,646.7	118,062.4	11.5	Japan	4,254	27.7	5.0	10.4	March

THE DATAMATION 100

THE LEADING WORLDWIDE DP COMPANIES

1985 RANK	1984 RANK	COMPANY	1985 TOTAL REVENUE	1985 DP REVENUE	1984 DP REVENUE	DP REV % CHG
51	52	**Intergraph Corp.**	$526.4	$526.4	$403.8	30.4
52	61	**Compaq Computer Corp.**	503.9	503.9	329.0	53.2
53	—	**Compagnie Générale d'Electricité**	8,908.7	479.0	446.2	7.4
54	—	**Comdisco Inc.**	602.9	467.9	387.6	20.7
55	—	**British Telecom plc**	10,504.2	455.1	NA	NA
56	42	**Volkswagen AG**	17,855.2	452.9	390.4	16.0
57	46	**Computervision Corp.**	441.1	441.1	556.3	-20.7
58	58	**Martin Marietta Corp.**	4,410.1	429.9	361.5	18.9
59	44	**Datapoint Corp.**	404.2	404.2	556.2	-27.3
60	57	**Convergent Technologies Inc.**	395.2	395.2	361.7	9.3
61	51	**Racal Electronics plc**	1,627.0	380.8	462.7	-17.7
62	77	**Cray Research Inc.**	380.2	380.2	228.8	66.2
63	48	**Dataproducts Corp.**	378.4	378.4	438.8	-13.8
64	54	**Tektronix Inc.**	1,434.5	366.9	386.7	-5.1
65	63	**BASF**	15,092.6	357.1	298.3	19.7
66	60	**Mannesmann Kienzle GmbH**	448.1	355.7	343.0	3.7
67	75	**Zenith Electronics Corp.**	1,623.7	352.0	249.0	41.4
68	—	**Arthur Andersen**	1,573.9	343.6	281.7	22.0
69	—	**Xidex Corp.**	342.0	342.0	195.4	75.0
70	55	**Diebold Inc.**	410.9	324.2	374.1	-13.3
71	70	**Sanders Associates Inc.**	783.8	323.4	260.8	24.0
72	72	**Shared Medical Systems Corp.**	312.2	312.2	256.8	21.6
73	73	**M/A-COM Inc.**	855.2	305.4	250.0	22.2
74	80	**Apollo Computer Inc.**	295.6	295.6	215.9	36.9
75	67	**3M**	7,846.0	295.4	281.4	5.0
76	68	**Mitel Corp.**	294.8	294.8	289.4	1.9
77	69	**Ferranti plc**	737.2	282.1	266.0	6.1
78	76	**Continental Telecom Inc.**	2,557.0	277.8	242.4	14.6
79	71	**Boeing Co.**	13,636.0	270.0	260.0	3.8
80	79	**Gould Inc.**	1,420.1	269.4	224.5	20.0
81	53	**Tandon Corp.**	268.8	268.8	398.5	-32.5
82	84	**NBI Inc.**	260.7	260.7	191.1	36.4
83	74	**Perkin-Elmer Corp.**	1,310.0	259.0	233.0	11.2
84	—	**MAI Basic Four Inc.**	252.8	252.8	NA	NA
85	66	**Paradyne Corp.**	252.5	252.5	289.9	-12.9
86	64	**Plessey Co. plc**	1,862.0	250.0	290.0	-13.8
87	82	**Cap Gemini Sogeti**	245.1	245.1	205.9	19.0
88	—	**Sterling Software Inc.**	238.8	238.8	196.9	21.3
89	100	**Lotus Development Corp.**	225.5	225.5	156.9	43.7
90	—	**Atlantic Computers plc**	234.8	224.4	120.0	87.0
91	—	**Sony Corp.**	5,994.8	221.8	247.3	-10.3
92	96	**Norsk Data AS**	219.8	219.8	166.6	31.9
93	87	**Nokia Corp.**	1,777.5	217.6	181.0	20.2
94	92	**Centronics Data Computer Corp.**	216.2	216.2	171.5	26.1
95	62	**Seagate Technology**	214.6	214.6	343.9	-37.6
96	78	**General Instrument Corp.**	848.0	210.2	248.7	-15.5
97	—	**Eastman Kodak Co.**	10,631.0	210.0	219.0	-4.1
98	86	**Gerber Scientific Inc.**	207.2	207.2	213.2	-2.8
99	85	**Quotron Systems Inc.**	205.7	205.7	189.8	8.4
100	59	**Thorn EMI**	4,108.4	205.0	346.7	-40.9

All dollar figures are in millions. NA: not available.

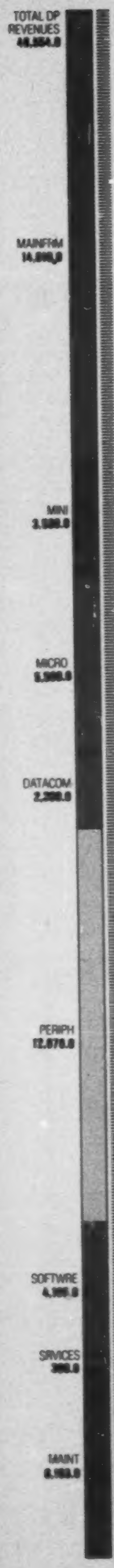
	NONDOLLAR ACCTG CURRENCY					R&D			FISCAL
DP AS % OF TOT	1985 DP	1984 DP	% CHG	CNTRY	1985 EMPL	CORP 1985	AS % OF TOT REV	NET INCOME	YEAR END
100					5,065	$50.7	9.6	$67.8	Dec.
100					1,860	15.9	3.1	26.6	Dec.
5	FF4,300.0	3,900.0	10.3	France	155,000	NA	NA	111.4	Dec.
78					NA	NA	NA	87.5	Dec.
4	£355.0	NA	NA	U.K.	232,000	243.6	2.3	1,341.1	Dec.
3	DM1,331.7	1,112.6	19.7	W. Ger.	NA	NA	NA	NA	Dec.
100					4,770	61.6	13.8	-80.8	Dec.
10					66,000	176.2	4.0	249.4	Dec.
100					5,993	44.7	11.1	-62.1	July
100					1,992	28.4	7.1	11.5	Dec.
23	£297.0	347.0	-14.7	U.K.	33,000	102.6	6.3	138.5	March
100					3,180	49.2	12.9	75.6	Dec.
100					4,100	31.2	8.2	23.4	March
26					20,094	201.5	14.0	92.7	May
2	DM1,050.0	850.0	23.5	W. Ger.	130,173	850.2	5.6	NA	Dec.
79	DM1,046.0	977.6	7.0	W. Ger.	8,246	NA	NA	NA	Dec.
22					33,000	96.0	5.9	-7.7	Dec.
22					29,802	NA	NA	NA	Aug.
100					NA	NA	NA	17.8	June
79					5,229	16.4	4.0	30.4	Dec.
41					11,413	40.1	5.1	35.1	July
100					3,300	28.5	9.1	41.7	Dec.
36					11,790	116.0	13.6	32.6	Sept.
100					3,400	41.5	14.0	-1.5	Dec.
4					85,466	507.0	6.5	664.0	Dec.
100	C$403.9	371.0	8.9	Canada	5,233	NA	NA	-23.1	Feb.
38	£220.0	199.5	10.3	U.K.	20,981	NA	NA	38.6	March
11					22,000	NA	NA	240.0	Dec.
2					104,000	409.0	3.0	566.0	Dec.
19					18,605	189.8	13.4	-175.7	Dec.
100					3,100	12.3	4.6	-135.4	Sept.
100					NA	NA	NA	7.9	June
20					15,515	114.3	8.7	82.1	July
100					2,722	15.0	5.9	8.2	Sept.
100					3,749	23.9	9.5	-31.2	Dec.
13	£195.0	217.5	-10.3	U.K.	37,533	107.4	5.8	104.0	Mar.
100	FF2,200.0	1,800.0	22.2	France	5,200	12.3	5.0	14.1	Dec.
100					3,000	NA	NA	-7.7	Sept.
100					NA	21.2	9.4	38.2	Dec.
96	£175.0	90.0	94.4	U.K.	NA	1.9	NA	21.2	Dec.
4	¥52,806.6	58,888.6	-10.3	Japan	44.908	464.7	7.8	306.7	Oct.
100	NOK1,888.0	1,360.0	38.8	Norway	NA	NA	NA	NA	Dec.
12	FMK1,349.0	1,086.0	24.2	Finland	28,000	77.3	NA	NA	Dec.
100					1,700	10.4	4.8	0.6	Dec.
100					5,700	19.3	9.0	1.0	June
25					NA	52.5	20.8	-106.7	Feb.
2					128,950	976.0	9.2	332.0	Dec.
100					NA	16.9	8.2	19.7	April
100					1,701	17.0	8.3	22.0	Dec.
5	£159.9	260.0	-38.5	U.K.	NA	NA	NA	NA	March

THE U.S. 100

THE LEADING U.S. DP COMPANIES

1985 RANK	COMPANY	1985 DP REVENUE
1	International Business Machines	$48,554.0
2	Digital Equipment Corp.	7,029.4
3	Sperry Corp.	4,755.1
4	Burroughs Corp.	4,685.3
5	NCR Corp.	3,885.5
6	Control Data Corp.	3,679.7
7	Hewlett-Packard Co.	3,675.0
8	Wang Laboratories Inc.	2,428.3
9	Xerox Corp.	1,959.0
10	Honeywell Inc.	1,951.9
11	Apple Computer Corp.	1,753.8
12	AT&T Co.	1,500.0
13	TRW Inc.	1,450.0
14	Tandy Corp.	1,200.0
15	Data General Corp.	1,199.7
16	General Electric Co.	1,130.0
17	McDonnell Douglas Corp.	1,104.5
18	Automatic Data Processing Inc.	1,102.1
19	General Motors Corp.	978.3
20	Amdahl Corp.	862.0
21	Harris Corp.	810.0
22	Computer Sciences Corp.	800.7
23	Prime Computer Inc.	769.7
24	ITT Corp.	756.0
25	Commodore International Ltd.	750.0
25	Texas Instruments Inc.	750.0
27	Motorola Inc.	704.0
28	Storage Technology Corp.	673.4
29	National Semiconductor Corp.	650.0
30	Tandem Computers Inc.	634.6
31	Telex Corp.	597.4
32	Intergraph Corp.	526.4
33	Compaq Computer Corp.	503.9
34	Comdisco Inc.	467.9
35	Computervision Corp.	441.1
36	Martin Marietta Corp.	429.9
37	Datapoint Corp.	404.2
38	Convergent Technologies Inc.	395.2
39	Cray Research Inc.	380.2
40	Dataproducts Corp.	378.4
41	Tektronix Inc.	366.9
42	Zenith Electronics Corp.	352.0
43	Arthur Andersen & Co.	343.6
44	Xidex Corp.	342.0
45	Diebold Inc.	324.2
46	Sanders Associates Inc.	323.4
47	Shared Medical Systems Corp.	312.2
48	M/A-COM Inc.	305.4
49	Apollo Computer Inc.	295.6
50	3M	295.4
51	Continental Telecom Inc.	$277.8
52	Boeing Co.	270.0
53	Gould Inc.	269.4
54	Tandon Corp.	268.8
55	NBI Inc.	260.7
56	Perkin-Elmer Corp.	259.0
57	MAI Basic Four Inc.	252.8
58	Paradyne Corp.	252.5
59	Sterling Software Inc.	238.8
60	Lotus Development Corp.	225.5
61	Centronics Data Computer Corp.	216.2
62	Seagate Technology	214.6
63	General Instrument Corp.	210.2
64	Eastman Kodak Co.	210.0
65	Gerber Scientific Inc.	207.2
66	Quotron Systems Inc.	205.7
67	UCCEL Corp.	204.8
68	Planning Reasearch Corp.	203.0
69	Micom Systems Inc.	194.2
70	Intel Corp.	187.2
71	Cullinet Software Inc.	182.8
72	General DataComm Industries Inc.	179.4
73	Reynolds & Reynolds Co.	178.0
74	Decision Data Computer Corp.	176.4
75	ISC Systems Corp.	175.0
76	Computer Associates Int'l Inc.	170.4
77	Recognition Equipment Inc.	163.1
78	Microsoft Corp.	162.6
79	Mead Corp.	153.8
80	Cipher Data Products Inc.	152.5
81	Management Science America Inc.	151.7
82	Ameritech	150.0
82	Signal Cos.	150.0
84	CPT Corp.	149.3
85	National Data Corp.	149.1
86	Printronix Inc.	148.4
87	Telerate Inc.	148.0
88	Software AG Systems Inc.	143.0
89	Xebec	136.2
90	Daisy Systems Corp.	133.6
91	Lear Siegler Inc.	130.0
91	Schlumberger Ltd.	130.0
93	Floating Point Systems Inc.	128.3
94	Intelligent Systems Inc.	125.0
95	InteCom Inc.	123.6
96	Sun Micro Systems Inc.	115.0
97	American Management Systems Inc.	112.2
98	Commmerce Clearing House Inc.	112.0
98	Computer Consoles Inc.	112.0
100	Ashton-Tate	110.4

All dollar figures are in millions. NA: Not available.



Revenue figures are in millions of dollars. Each increment represents $100 million.

1

INTERNATIONAL BUSINESS MACHINES CORP.

Old Orchard Rd.
Armonk, NY 10504
(914) 765-1900

Despite its dominance of the computer market, IBM found 1985 a year of tough sledding. "Trying" was the word it used. Gross revenues rose 9% to $50.06 billion, up from the previous year's $45.94 billion, but net earnings slipped 0.4% to $6.55 billion. Nonetheless, IBM's return on equity was a none-too-shabby 22.4%—down from 1984's 26.5%.

IBM blamed its disappointing performance on "an uncertain North American economy, currency fluctuations, sluggish capital spending," and an early 1985 pre-Sierra slowdown in mainframe orders.

Growth was strongest in non-U.S. operations, showing a 16% increase in gross income, to $21.54 billion, and a 19% increase in net earnings, to $3.08 billion. IBM said currency rates helped the bottom line in the latter half of 1985, but their effect over the year was negative. IBM's business continued to be centered around its System/370 mainframes, even as the expanding PC family and other small systems remained important. IBM is thought to earn about 50% of its total profits from mainframe products.

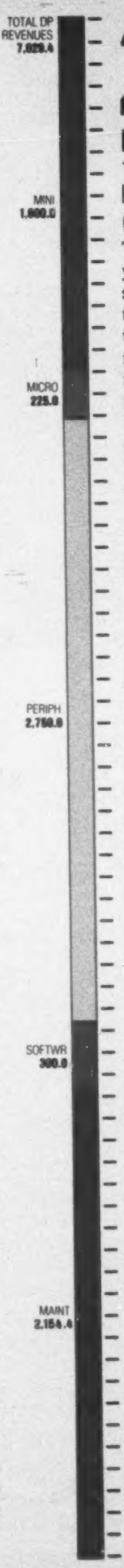
As IBM struggled to cut costs and maintain profit margins and market share, it was busy preparing to achieve its goal of $200 billion in revenues by 1994. Among other actions, the company reorganized its U.S. sales force, arranged to exchange most of its ailing Satellite Business Systems subsidiary for a sizable equity position in common-carrier MCI Communications Corp., entered into a variety of joint ventures in U.S. and foreign markets, and invested $4.7 billion in R&D and engineering, and $6.1 billion in new plant and equipment.

Product introduction highlights included the Sierra/3090 family of large-scale mainframes; the first pieces of a token ring office network; a double-capacity 3380 disk drive; and upgrades to its PC, System/3X, and 4300 system families. The Sierra processors were fairly well accepted by customers: IBM found it necessary to hasten production and delivery schedules.

Still, as 1986 began, IBM's inventories were surprisingly high and speculation arose that, in comparison with the still-active 308X generation, the Sierras were not as attractive to customers as they might be. Moreover, IBM's midsized, 4300-series systems came under heavy attack from large minicomputers sold by Digital and others.

The sales/services/rental mix of IBM's business continued to evolve. Gross income from software and services (totaling $11.5 billion) accounted for 23% of total revenues in 1985, up from 21% in '84; rentals dropped to 8% of the total from 14%.

Generally, IBM's hardware prices continued to fall (earlier than expected, in some cases, as the firm tried to stimulate orders and ward off competition), but wide-ranging software price increases helped raise its total worldwide software revenues to $4.16 billion, some 30% more than the comparable 1984 figure.



Revenue figures are in millions of dollars. Each increment represents $100 million.

2

DIGITAL EQUIPMENT CORP.

146 Main St.
Maynard, MA 01754
(617) 897-5111

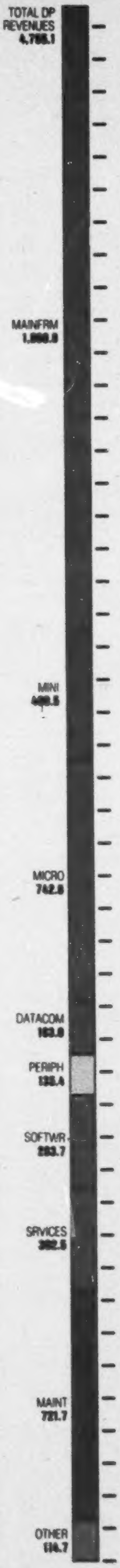
The "new" DEC looms large in the industry. Next year the company is expected to crack the $10 billion sales barrier, and already a cultural and organizational shift is evident in its business as it prepares for the event. No longer a "stuffy engineering" company, Digital showed off its new marketing orientation in 1985 by mounting major showcase exhibitions of its full product line in France—DECville, and in the U.S.—DECworld. Last year saw the debuts of a much simpler organizational structure and product line, which resulted in better asset management: increased cash reserves and sharply decreased inventories.

In 1985, DEC forged new international accords—particularly in the embryonic South American marketplace. Above all, 1985 was a year of product transition: after a two-year delay, the first two members of the new VAX family appeared. DEC's challenge throughout the year was to maintain high revenue growth (the company grew 20% in '83 and 29% in '84), given the dramatic price declines that have accompanied the miniaturization of its new VAX line, the industry slump, and the costs of selling to more market-driven end users.

Ultimately, DEC's performance last year was linked more to the vagaries of the sluggish domestic economy than to any virtues or shortcomings of its product line. Total revenues grew by a modest 12.8% to $7.03 billion, driven primarily by the new 4MIPS VAX 8600 that began volume shipments in April, and the two-chip MicroVAX II departmental computer that reached volume in the second half of 1985. A nearly flat economy and the costs of DEC's structural and product transition squeezed the company's net profit, which dipped 17.5% to $401 million. (Note: last year's net profit of $487 million was artificially inflated by a one-time nonrecurring tax benefit of $63 million. If this gain is excluded, net profit declined only 5.5%.) Despite the safety net of a huge installed customer base, 40% of DEC's total sales still come from OEMs, who are vulnerable to cyclical swings in the economy. DEC cited the U.S. manufacturing sector as being particularly weak in 1985.

The picture overseas was much rosier: sales grew 25.4% to $2.8 billion, or 40% of all revenue. DEC was the first major vendor to endorse the seven-level OSI architectural standard, and intends to base future products on the model. Other highlights included the opening of a manufacturing facility in Mexico and the licensing of a Brazilian firm, Elebra Computerdoro, to manufacture its VAX computers.

As Digital matures and closes in on the magic $10 billion mark, it begins to bear a structural resemblance to its main competitor, IBM. Hardware revenue growth has slowed appreciably and the slack is now taken up by software and service revenue. DEC's service and field support revenue alone topped $2 billion in 1985. Unlike IBM, whose inventories continued to pile up to record levels ($8 billion-plus) in 1985, DEC reduced its $2 billion-plus inventory by $600 million, or 30%, last year.



3

SPERRY CORP.

1290 Avenue of the Americas
New York, NY 10104
(212) 484-4444

Sperry's 1985 was a year of divestment and concentration on electronics and information processing. The company sold its New Holland farm equipment division to Ford Motor Co. It also entered into merger talks with fellow mainframer Burroughs Corp., but nothing came of them. Meanwhile, as always, the company worked to take advantage of its sizeable installed base of mainframes, hoping to sell integrated systems that would keep its customers from defecting to IBM.

Sperry reported total computing-related revenues of $4.755 billion for 1985, up 18% from $4.015 billion the previous year.

Sperry concentrated its marketing efforts in five main industries: communications, energy and engineering, airline and travel, manufacturing, and government.

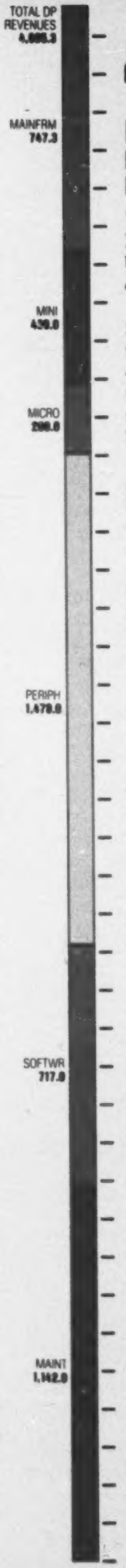
The company added two entry-level 1100/90 systems to its major mainframe line, disclosed plans to develop a "new family" of System 80 midrange mainframes, introduced a scientific processor for 1100/90s, and started selling a new database machine. The company found further strong acceptance of its Sperrylink office automation system, claiming to have installed some 90,000 desktop and deskside systems during the fiscal year ended March 31, 1986.

Like other mainframe companies, Sperry has begun reselling small computers supplied by other manufacturers. It has also adopted other firms' operating systems such as Unix and MS/DOS. These moves are designed to cut development costs and attack the perennial problem of supplying customers with a sufficient choice of applications software. The strategy is not without its dangers: Sperry's deal with Encore Computer failed to live up to its promise, largely because Encore's multiprocessor computer never really worked as Sperry had originally hoped.

In the pc marketplace, Sperry added to its line of Mitsubishi-built machines a product designed to compete with IBM's PC AT; the product is sold directly to Sperry mainframe customers as well as through volume distributors and value-added resellers. Sperry agreed with Hitachi Ltd. to jointly explore semiconductor, disk drive, and software development technologies. It also signed marketing agreements for Texas Instruments' artificial intelligence workstation and Intellicorp's expert system software tool. (Sperry also secured an equity interest in Intellicorp.) In a new marketing twist, Sperry began franchising its Mapper database software to other organizations, enabling them to set up industry-specific timesharing services and sell Mapper-based packages.

Sperry announced late in the year that by Sept. 1, 1986, its executive offices will have moved to Blue Bell, Pa. The company said the move represents the continued consolidation of corporate and commercial computer staffs, furthering the strategy that ceo G.G. Probst calls "one Sperry." Later, staff functions in the defense and aerospace groups will also be consolidated.

Revenue figures are in millions of dollars. Each increment represents $100 million.



4

BURROUGHS CORP.

Burroughs Place
Detroit, MI 48232
(313) 972-7000

Last year proved just blah for Burroughs: no thrills, but fewer chills than others in the industry experienced.

Revenues were up 4.7%, to $5.03 billion from $4.81 billion in 1984. Net income improved only 1%, to $248.2 million from $244.9 million in 1984. The 4.7% revenue gain included an 8.8% sales increase to $3.53 billion, an 18.8% decline in rentals to $369.5 million, and a 2.7% rise in service revenues to $1.14 billion.

Equipment shipments to commercial and government customers were up about 9%, to $2.6 billion, analysts estimate, compared to a 21% increase in 1984. R&D expenditures for the year were estimated at $285.2 million, up 7% from 1984.

Despite two major product announcements this year, the A-15 and V series, machines that match the performance specifications of IBM's 3090 series; the introduction of the A-10, a follow-on to the two-year-old A-9; and the continued success of the company's B-25 workstation, Burroughs showed only a nominal 8% increase in orders in 1985, with more strength overseas than in the U.S. Delays in shipping a new operating system for the V series may have contributed to the slow order growth in the U.S. International business comprised 35% of the company's total business in 1985, with Japan the largest customer, followed by the U.K., France, Brazil, and Australia.

The Memorex division continues to be plagued by problems in building thin-film disk drives, and by aggressive pricing at IBM and by the Japanese. Analysts estimate that the $1 billion division lost about $20 million for the year.

Both analysts and the company expect Memorex to at least break even in 1986.

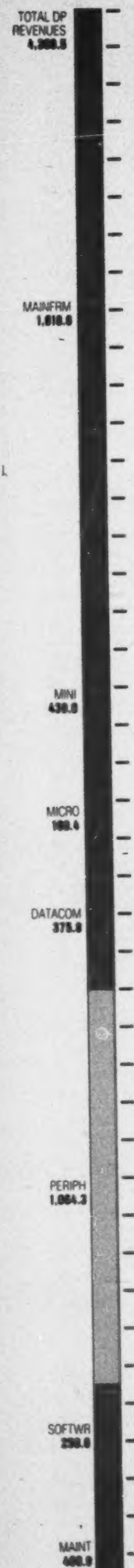
If Memorex indeed returns to something like health, and volume shipments of the new A series and V series machines materialize as predicted, an improved financial picture is almost inevitable for Burroughs. In 1985, looking to cut costs, Burroughs closed eight plants and laid off 5,000 employees.

The DATAMATION/Cowen & Co. survey of mainframe sites indicates that a high proportion of Burroughs users plan to migrate to the new A and V series hardware; the results of this business, however, may not be felt until 1987. Nevertheless, the A and V series introductions have given the company a much-needed shot in the arm.

This spring the company introduced a new, in-house designed 80186-based microcomputer, the first micro line Burroughs has developed and produced itself. The product, the B-27, falls in the midrange of Burroughs workstation offerings.

Though the company's attempt to merge with Sperry last year failed, Burrough's management says the company is continuing to look for strategic partners with whom to merge or to acquire. From time to time, rumors surface that place Burroughs in merger—but so far they've proved untrue.

Revenue figures are in millions of dollars. Each increment represents $100 million.



5

FUJITSU LTD.

Marunouchi Center Bldg.
1-6 Marunouchi 1-Chome
Chiyoda-ku, Tokyo 100, Japan
(81-3) 211-5236

Fierce domestic competition from NEC and IBM combined with sluggish exports cast a shadow over Fujitsu's 1985 profits. DATAMATION estimates that Fujitsu's revenues rose only 6% and net income plummeted 32.9%. While dp revenues increased 12.2% to $4.3 billion (¥1.02 trillion), competition from IBM's Japanese subsidiary suggested that interesting times are ahead. Outstripping Big Blue in domestic sales, plug-compatible expert Fujitsu nevertheless lost ground to IBM in several important categories.

Healthy sales of IBM's Sierra series and 5500 family of workstations eroded Fujitsu's market share; the firm's November announcement of its top-of-the-line M-780 series of mainframes came a bit too late to stop IBM. In 1985 Big Blue took roughly 31% of the Japanese mainframe market, compared to Fujitsu's 29% stake. In the local micro market, IBM captured 22.9%, compared to Fujitsu's 18.3%.

As IBM turned up the heat, Fujitsu appeared to be moving away from complete plug compatibility. In its new M-780 family, for example, Fujitsu promised only to maintain compatibility with its own M-series operating system. Complicating the compatibility issue is an IBM allegation that Fujitsu illegally used IBM software.

Fujitsu continued to rely on Amdahl—49.5% owned by the Japanese mainframer—for technical collaboration and North American distribution of hardware made in Japan. Three new Fujitsu subsidiaries were established in North America in 1985 to beef up distribution and service networks for microcomputers and telecom equipment.

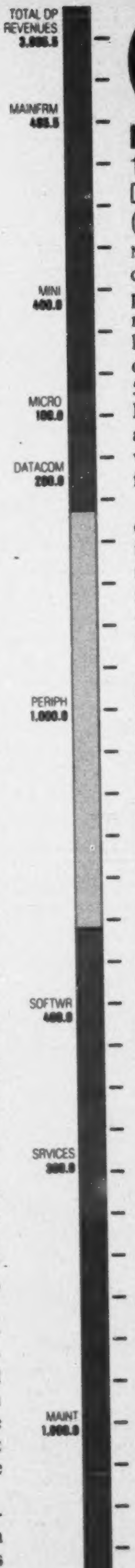
In Europe, Fujitsu merged its Spanish subsidiary with local dp company Secoinsa. The new company, 60% controlled by Fujitsu, will manufacture midsize mainframes for the European market by 1990. European observers speculate that Fujitsu may use Secoinsa as a beachhead in Europe, where it currently has only oem links.

For MFLOPS-hungry users, Fujitsu came out with the VP-series of supercomputers for scientific and engineering applications in 1985. But with only 18 orders to date, Fujitsu has a long way to go before supercomputer sales make a major contribution to total corporate revenues.

Partial deregulation of Japanese telecom provided opportunities for Fujitsu last year, and diversification into telecommunications equipment and data communications networks helped to brighten up a difficult year. Fujitsu took a leading share of the Japanese market for digital multiplexors and packet switching devices, but the strengthening yen at the end of 1985 cut into foreign sales.

Long pauses between new product introductions underscored the difficulty of keeping up with IBM in 1985. Shrinking profits from the PCM business and the software dispute with IBM are forcing Fujitsu to reexamine the risks of playing follow the leader.

Revenue figures are in millions of dollars. Each increment represents $100 million.



6

NCR CORP.

1700 South Patterson Blvd.
Dayton, Ohio 45479
(513) 445-5000

NCR Corp. squeaked through the slump of 1985 in one piece, but segments of the company's business, particularly office systems and workstations, took a real beating. Net income was off 8% to $315.2 million from 1984 earnings that had been inflated by a change in the tax laws. Corporate revenues were up 5.9%, to $4.32 billion from $4.07 billion in 1984. Revenues include an estimated 5% increase in sales, a 14% decline in rentals, and a 12% increase in service. R&D expenditures were $299 million, up 3.5% from $289 million in 1984.

Total dp revenues increased 5.8% in 1985, down from the 10.1% increase the company reported in 1984. Still, NCR showed real growth in the terminal market, with retail terminals and systems revenue up 15% in 1985, compared to a 3% increase in 1984. Financial terminals and systems revenue was up 4% in 1985 after gaining 1% in 1984.

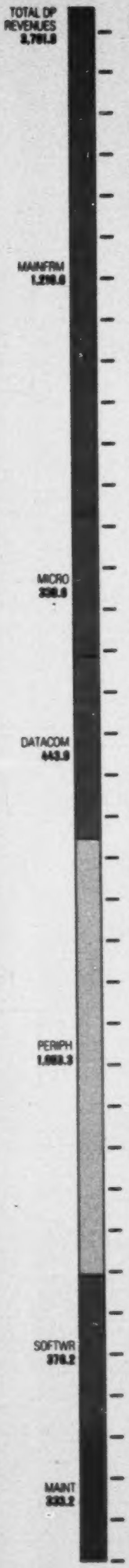
Problem areas at the company include the personal computer, semiconductor, and office systems businesses, all of which were unprofitable. Some analysts estimate the company lost nearly $70 million among the three in 1985. Price wars decimated a disappointing pc market last year, and semiconductor revenue fell 8%, compared to a 7% gain in 1984. Moreover, the company has had virtually no luck selling its 32-bit chip set outside the company. More encouraging, NCR signed a deal with Hitachi to oem $25 million worth of 8-inch Winchester disk drives.

Revenue for general purpose data entry and inquiry workstations, manufacturing workstations, and micrographic systems declined 19%, compared to an increase of 14% in 1984 and 17% in 1983. NCR maintains, however, that trouble is a thing of the past in the personal computer area, where volumes are rising and NCR's dealer network is expanding rapidly. While the microcomputer area has been a sore spot for the company over the past few years—sales from the company's two micros were so low in 1984 that one model was taken out of domestic production—NCR apparently is banking on a stronger showing in 1986. The company expanded its micro line in 1985, adding the PC8, a high-end personal computer that can function as a multi-user system, and the PC6. NCR also added two supermicrocomputers to its Unix-based Tower line. It also introduced a retail personal computer aimed at small retailers, and some optimistic analysts are predicting that in 1986 NCR's pc business could break even.

The company rolled out several other new products last year, including two superminicomputers, the 9400 and 9500, which incorporate the company's 32-bit VLSI chip technology.

A new element in the corporate structure of NCR was the creation at the corporate level of a new division for product marketing and strategic planning. The company also expanded the product management area of the development and production divisions by adding several senior managers.

Revenue figures are in millions of dollars. Each increment represents $100 million.



7

NEC CORP.

33-1 Shiba 5-Chome
Minato-ku, Tokyo 108, Japan
(81-3) 454-1111

In 1985, NEC relied on a strong dp base to offset plunging profits in the chip business. NEC dp sales now account for 38% of total revenues. DATAMATION estimates that total corporate revenues rose almost 10% in 1985 to $9.9 billion (¥2.3 trillion), but net income sagged 3.1% in spite of the company's efforts to move to higher-margin businesses.

NEC has carved out an expanding market niche where IBM compatibility doesn't matter. Its ACOS mainframes run operating systems that reflect NEC's historic ties with General Electric and Honeywell. Unlike Hitachi and Fujitsu, NEC has been able to concentrate on mainframe technology and performance instead of anticipating IBM product announcement. Although NEC exports less than 15% of its computer production, strategic alliances with GEISCO and France's Bull may help to increase that share. GEISCO now uses NEC mainframes as the hub of an expanding international teleprocessing network.

NEC broadened its mainframe offerings by rolling out the ACOS 1500 series in 1985. Japanese public sector sales accounted for the majority of NEC's mainframe sales. In the Japanese office market, NEC competed strongly against Oki and Mitsubishi Electric with its MS series of 32-bit minis. Although NEC installed two of its SX-1 supercomputers in-house, it failed to announce an outside sale during 1985.

Long the front-runner in Japanese microcomputer production, NEC has widened that lead, taking 70% of the domestic market for 16-bit machines. But NEC's efforts to sell micros abroad never got off the ground in 1985, even with attempts at compatibility with IBM.

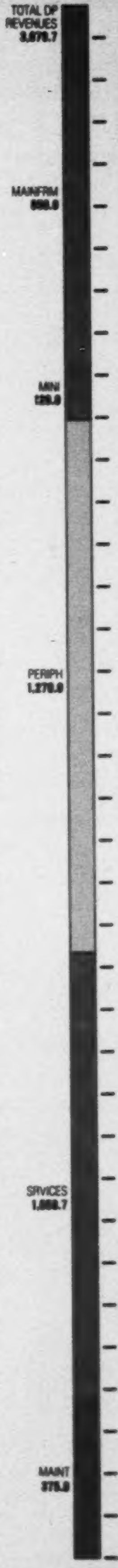
NEC bought Honeywell Information Systems Japan in 1985. Ironically, it was the BUNCH company that had helped NEC enter the computer business, with technical cooperation going back to their first agreement in 1962.

GE and NEC formed a joint venture, C&C International, aimed at integrating their international networks. The collaboration allows Japanese NEC-Net users to access GE's MARK III teleprocessing services. Eventually, if Japanese restrictions on international telecom are removed, linkage of NEC-Net and GE's MARK Net will form a global value-added network.

NEC is one of the few Japanese companies to have a proprietary microprocessor design. The latest additions to the V series cpu family, the V30 and V40, attracted rave reviews in 1985 as well as a lawsuit from Intel charging that NEC violated copyrights on the microcode. NEC promptly countersued but courts have yet to reach a final decision.

On the communications side, NEC still relies on quasi-privatized Nippon Telegraph and Telephone for about 25% of total sales. Digital switches, transmission equipment, switching systems, and optical components have been NEC's cash cow. Surging sales to the liberalized U.S. telecom market accounted for another 25% of telecom revenues, through its subsidiary, NEC America.

Revenue figures are in millions of dollars. Each increment represents $100 million.



8

CONTROL DATA CORP.

8100 34th Ave. S.
Bloomington, MN 55440
(612) 853-8100

CDC's financial performance in 1985 was the worst in the company's history. Total losses were $567.5 million, compared with a profit of $31.6 million in 1984. Of that loss, the computer business accounted for $562.7 million.

Amid 1985's financial crisis came the announcement that the company's founder, chairman and ceo William C. Norris, was retiring. Norris, 74, came under increasing fire from the company's critics, particularly on Wall Street, who blame CDC's problems on his leadership and his philosophies concerning corporate social responsibilities. Plato, the company's computer-based education and training business, has often been at the crux of such criticism. Norris believes Plato, which cost some $900 million to develop, is the future of the company, but many disagree. Norris's retirement and the appointment of CDC president Robert M. Price as successor is widely judged a a positive step.

CDC reduced its work force by 10,000 and closed or sold six plants. It also sold a few units, including its business products division. At press time, the company had a letter of intent from Allen and Co., a New York investment house, for the sale of the company's profitable Ticketron unit, a computerized ticketing service. The sale price was not disclosed; analysts estimate Ticketron had revenues of $100 million in 1985. Robert Price said in January that the total 1985 revenue of the businesses that the company dropped by first quarter 1986 equaled $400 million, 9% of computer business revenues.

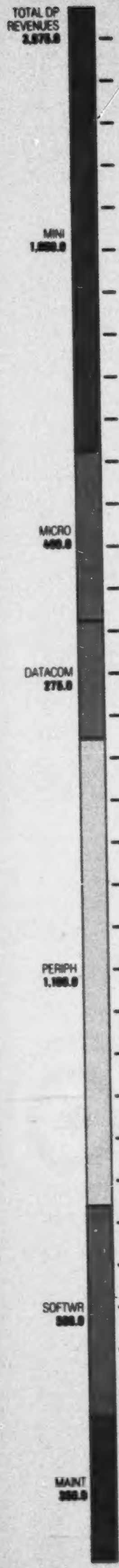
Meanwhile, CDC withdrew the proposed sale of money-losing Commercial Credit Corp. The company restructured the unit, establishing it as a separate entitity from the parent company, and reduced the unit's size by two thirds. Following the withdrawal of the sale of Commercial Credit, CDC defaulted on short-term loans to the tune of $380 million, but negotiations to restructure the loans were successful. CDC has until year's end to pony up.

Overall orders in computer systems are said to be good, with demand for midrange Cyber 180s particularly encouraging. Chrysler Corp. also became a CDC customer, ordering $7 million worth of Cyber 180s. Officials in the computer systems group have hinted at possible additions to the Cyber line to be introduced in 1986.

CDC failed to attract investors for ETA Systems, a company spin-off that is manufacturing a supercomputer for release in the fourth quarter of 1986. CDC says it is not actively looking for investors anymore, but is not ruling out the possibility of future partners. ETA was underwritten by a $40 million equity investment by CDC.

Company officials say it is turning from a corporate culture of project management to profit management. No one doubts that CDC will survive this dismal period, but the question is, when the smoke clears will it emerge as a viable, innovative, and profitable supplier or a mere shadow of its former self?

Revenue figures are in millions of dollars. Each increment represents $100 million.



9

HEWLETT-PACKARD CO.

3000 Hanover St.
Palo Alto, CA 94304
(415) 857-1501

Hewlett-Packard swallowed some bitter medicine as it reported that annual profits had declined in 1985, the first time such a thing had happened in 10 years. Net revenues totaled $6.5 billion, an 8% increase over 1984. Net earnings were $489 million, or $1.91 per share, a drop from $2.59 per share in 1984. Orders for 1985 were $6.4 billion, a 1% increase over 1984. Unfilled orders stood at $1.2 billion compared with $1.3 billion the previous year.

David Packard, chairman of the board, and William R. Hewlett, board vice chairman, were candid about 1985's problems. In a statement also signed by John R. Young, HP's president, they said, "Several factors contributed to a disappointing year for HP and our industry. Business outlays for plant and equipment, which HP sales traditionally track, slowed significantly. U.S. defense-related electronics purchases also slowed as many projects neared completion and as the procurement process underwent intense scrutiny. The increasingly strong U.S. dollar in the first part of the year meant higher local currency prices for equipment manufactured in the U.S. and sold abroad . . . ."

To offset losses, the firm instituted pay cuts and limited hiring sharply, though the end of 1985 saw the company with 2,000 more employees than it had begun the year with: 84,000 workers worldwide, with 56,000 of them in the U.S.

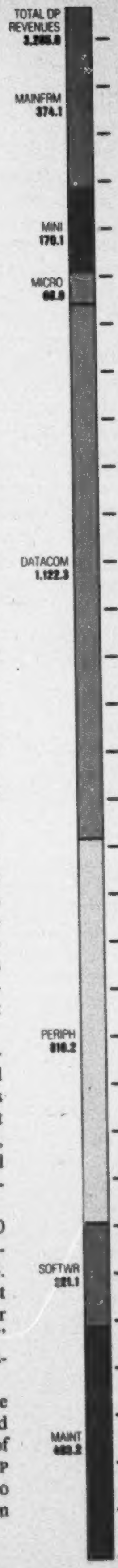
The company released a battery of new products, among them 282 new software packages; the Vectra supermicrocomputer with performance levels above IBM's PC AT; and a variety of enhancements to its AdvanceNet, an IEEE 802.3-based LAN. Continuing its presence abroad, where 43% of its 1985 orders originated, the firm established field marketing centers in Lyon and Grenoble, France; Böblingen, West Germany; Amsterdam; and Hong Kong.

During the year, much was made of Spectrum, a promised-for-1986 version of HP's RISC-based workhorse 3000 supermini. The 3000, critics charged, had been around for donkey's years; while it was the backbone of HP's office automation effort, they said, it had not been enhanced in years and stood in danger of losing major market share to competitors like DEC.

To these charges HP rejoined that the 3000 now enjoys an installed base of 23,000 units worldwide, with more sold in 1985 than were sold in 1984. "Despite all that press commentary [on why HP must unleash Spectrum], we didn't lose a single major 3000 account in 1985 and even got some new ones," said John Doyle, head of the firm's Information Systems and Networks division.

HP was said to be hustling like mad behind the scenes to produce its 3000 upgrades, to be released later this year as the HP 3000 Series 930, capable of 5MIPS using conventional TTL technology; and the HP 3000 Series 950, a true RISC machine expected to achieve some 6.7MIPS and scheduled for release in mid-1987.

Revenue figures are in millions of dollars. Each increment represents $100 million.



10

SIEMENS A.G.

Wittelsbacherplatz 2
8000 Munchen 2, West Germany
(49-89) 2340

After a corporate shake-up in 1984, West Germany's Siemens rolled through 1985 with dp revenues up by 17% to $3.3 billion (DM9.6 billion). Those upbeat sales came predominantly from the Communication and Information Systems Group (CISG) formed in 1984 by the merger of the company's computer and business communications operations. Siemens' other dp business stemmed from its automation and power engineering groups, which sell products that incorporate dp and datacom equipment.

The company paid special attention to developing its mainframes in 1985, introducing 11 new models, from the 7.530 starting at under 1MIPS, to the 7.590 at 15MIPS. Higher up the scale, it also brought to market new models in its 7.800 series, based on Fujitsu machines, raising the power ceiling to 27MIPS. The company ended the year with an installed base of over 2,000 machines, of which 220 were Fujitsu-built.

Siemens also launched the PC 2000 desktop mainframe, which runs the company's BS2000 operating system and can be used in an IBM VM environment. Siemens claims this product was the first full-fledged implementation of a mainframe operating system on a pc.

Enhancements made to the BS2000 operating system moved it increasingly toward IBM compatibility. That's a shrewd political direction for the company, since a Fujitsu operating system sold by Siemens as the BS3000 suffered problems and customers complained. As a result, and in the wake of IBM's tussle with Fujitsu over copyrights, Siemens stopped selling the BS3000 this year.

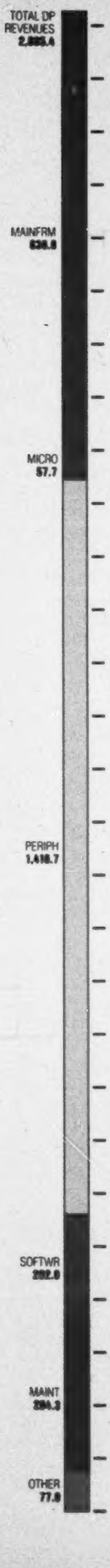
Siemens already has closer relationships with IBM than most other mainframers as a result of its oem deal to sell Big Blue's 3380 disk systems.

Siemens has grasped Unix with both hands. It was a founding member of the European X/Open Unix support group set up to develop a set of practical interface standards for the operating system. The company has sold almost 4,000 of its single- and multi-user systems based on its Xenix derivative, Sinix, and it introduced two new engineering workstations, the MX2 and MX4 running Sinex.

An early member of the European OSI support group, Siemens was also involved with the development of MAP standards in the U.S. The company extended its involvement with manufacturing standards, joining a project funded by the European Commission as part of the Esprit research program. Also involved are IBM, DEC, Bull, Alcatel, and British Aerospace. Further evidence of its factory systems strategy was revealed when Siemens bought a 49% stake in the Italian factory automation company, Electric Control Systems of Florence.

In business communications, Siemens introduced its Hicom digital PBX early in 1985. It has linked up with France's Alcatel, Britain's Plessey, Italy's Italtel, and GTE in the U.S. to develop standard ISDN switches for national networks.

Revenue figures are in millions of dollars. Each increment represents $100 million.



11

HITACHI LTD.

Kanda-Surugadai 4-Chome
Chiyoda-ku, Tokyo 101, Japan
(81-3) 258-1111

Hitachi proved in 1985 that it was not only tough but also tenacious when it comes to holding the compatible line. DATAMATION estimates that Hitachi's dp revenues grew 13% to $2.89 billion (¥687 billion), despite cutthroat competition at home and shrinking sales abroad. But profits for the corporation as a whole suffered, declining 8.1% to $768.6 million.

Hitachi relies heavily on its R&D muscle to meet the competitive challenge presented by Big Blue. The company rolled out its M-682H and M-680H mainframes in quick response to Sierra. By year-end, Hitachi had received orders for 50 Sierra-equivalent machines, most of those orders coming from the company's loyal customer base at Japanese banks and securities firms. The pcmer also landed more than 15 contracts for mainframe systems from the Bank of China.

Right after IBM began early deliveries of its new double-density disk drives, Hitachi unveiled its own models. With almost 20% of its computer division's sales coming from disk drives, Hitachi pinned its hopes on speedy introduction of the double-density drives to save market share. Production of these drives reached 300 units per month in 1985.

Hitachi had a good year from a peripherals point of view. Sales of optical storage devices, Winchester drives, and laser printers contributed about 50% of Hitachi's data processing revenues.

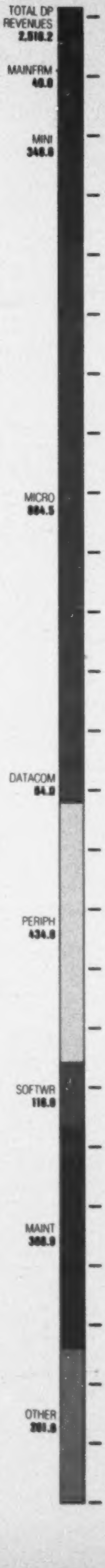
Business was decidedly slower in the supercomputer realm. Hitachi's S-810 series simply couldn't match Fujitsu's line of supercomputers when it came to benchmarking and price/performance. The company hopes it will have better luck with the S-810/5, a low-end supercomputer that it introduced at the end of the year.

Hitachi continued to rely on National Advanced Systems (NAS) to market its mainframe wares in the North American market. A subsidiary of National Semiconductor, NAS may be in trouble with Hitachi, which has heavy stakes in the chip business. The Japanese company is rumored to be looking for alternative distributors and investigating ways to beef up its American computer sales and service network. Things are a lot calmer in Europe, where Hitachi mainframes and peripherals are sold by BASF in West Germany and by Olivetti in Italy.

Meanwhile another American alliance may be in the offing this year. Sperry, which hankers for Hitachi's expertise in cpus, VLSI, and peripherals, held tie-up talks with Hitachi in 1985. No agreements were announced. Hitachi was rumored to be asking for some of Sperry's holdings in Nippon Univac Kaisha, which could help the firm pick up its pace in applications software development and expand its user base in the Japanese financial sector.

Fear of protectionism coupled with the rising yen prompted Hitachi to go ahead with plans to build a 5GB disk drive manufacturing plant in Norman, Okla. This is a major move by Hitachi, since its production has always been on its domestic turf.

Revenue figures are in millions of dollars. Each increment represents $100 million.



12

ING. C. OLIVETTI & CO. S.P.A.

Via G. Jervis, 77
10015 Ivrea, Italy
(39-125) 525

Under the guidance of chairman Carlo De Benedetti, Olivetti elbowed Apple out of the number two spot in the European personal computer market and more than doubled its worldwide pc sales. "It was definitely the year of the pc at Olivetti," recalls Vittorio Levi, the company's executive vice president of operations.

Nor was business bad elsewhere. Olivetti's total worldwide dp revenues were up by a massive 42% in local currency to L6.14 trillion ($2.52 billion). Mainframe sales shot up by 115%, datacom revenues rose by 23%, and software sales jumped by 35%. The only blot on the order book was in the minicomputer area: revenues were up only 6%.

But it was the pc side that really shone during 1985. Personal computer sales hit $884.5 million last year, representing a surge in business of 113.6% and accounting for 35% of the company's total dp take.

Much of this pc surge came from Olivetti's U.S. marketing deals with its transatlantic partner AT&T, and with Xerox which signed up to sell Olivetti pcs early last year. Pc shipments in 1985 reflect this U.S. activity—167,000 machines were shipped in Europe, 18,000 to the Far East and 190,000 to the U.S.

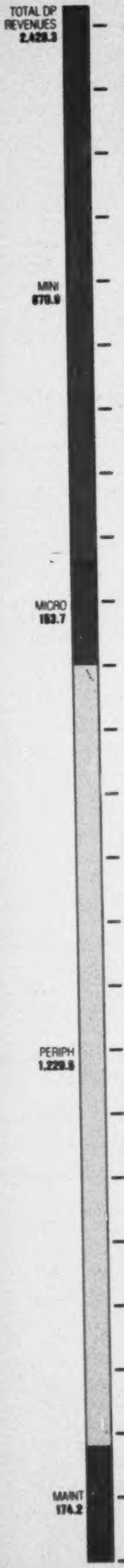
The U.S. was the company's largest export market last year, thanks to AT&T and Xerox. Olivetti's own foray into the U.S., through its loss-ridden joint venture Docutel/Olivetti, had little to do with the expansion of business. This year could be different following the acquisition last March of the remaining 54% of Docutel for $20.2 million.

In 1985, the company also purchased the European marketing network of Exxon Office Systems, bought a 49% stake in Start Computer Centre, the West German retailing firm, signed a strategic deal with Toshiba giving the Japanese company a 20% share in Olivetti's Japanese subsidiary, and took an 80% holding in the troubled U.K. educational micro company Acorn.

Olivetti also moved aggressively in the mainframe market last year. Claiming to be the number two in the Italian mainframe sector with an installed base of 115 Hitachi machines, the company signed up U.K. IBM specialist Fee of Watford to sell the systems in the U.K.; it is looking for similar partners in other European countries. But Olivetti is being cautious because previous attempts at selling mainframes outside Italy during the early '80s were disasters.

But perhaps the trend to watch in 1986 is further delegation of management responsibility at Olivetti. Executive vice president Levi and Elserino Piol, vice president of corporate strategy and development, took increasingly active roles in running the firm in 1985. De Benedetti is tied to the company through a 10-year employment contract with AT&T, and okays all strategic policies at the company, but with Olivetti holding steady at high speed, he can now afford to spend more time in the backseat.

Revenue figures are in millions of dollars. Each increment represents $100 million.



13

WANG LABORATORIES INC.

1 Industrial Ave.
Lowell, MA 01851
(617) 459-5000

The issue of customer loyalty dogged Wang in 1985. A stagnant product cycle and the late delivery of key strategic products—Wang Office and the high-end vs 300 supermini—conspired to sap user confidence in the first half of the year. After a record $109 million loss in the quarter ending June 30 and the resignation of president John Cunningham, founder An Wang firmly reseized the reins of the company. The company began to stabilize in the September quarter with record orders of $700 million, but the damage had been done. Total sales for the calendar year were virtually the same as 1984, at $2.43 billion, and the bottom line was grisly, with losses of $63.3 million in contrast to 1984's net profit of $230.7 million.

As Wang accelerated its shift from word processing to dp products, the company lost ground to IBM, DEC, and Data General. And some of Wang's largest customers began to doubt its ability to offer both integrated solutions and the crucial "three Cs": coexistence, compatibility, and communication with IBM.

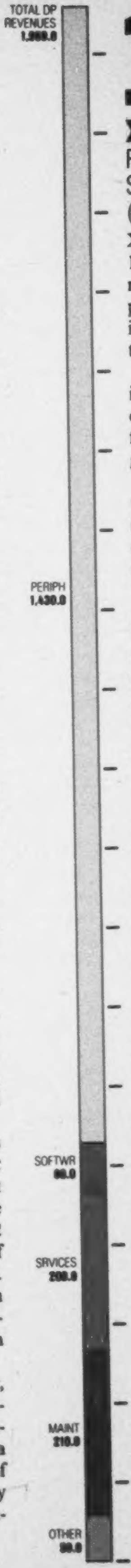
By midyear the company was placing new emphasis on the old rule, "Put the customer first." A notable step was a $38 million deal with the Hartford Insurance Group subsidiary, HITECH, to develop programmer productivity tools and workstations for MIS shops. Wang's hope was that the relationship with HITECH would help educate its own people in the ways of MIS. Because its experience has been in word processing, not dp, Wang has tended to use its customers as alpha sites for new dp offerings. Bad publicity about delivery of some unproved systems undermined customers' already shaky confidence in Wang's dp skills.

In June the company created a new independent subsidiary, Wang Information Services Corp., to offer remote information services to its customers. Included for sale, lease, or rental are nationwide electronic voice mail, telecommunications switching, database, and Wang Office services—even a shared tenant-smart building service.

One strategy Wang chose to counter its sales slump was emulating the SNA software and IBM PC support strategies of DEC and Data General. But Wang is generally viewed as a year behind these firms in providing such links, especially in the LU 6.2 area. Wang is trying, however, to differentiate itself from its rivals by offering PBX systems to MIS shops. To this end the company bought a 40% share—with an option to raise its stake to 51%—in the PBX supplier Telenova, Los Gatos, Calif. Wang already had a minority position in Intecom, Allen, Texas.

In the Pacific market, Wang had a lively year, entering three joint ventures in China and announcing a Japanese language pc. In Australia the company released progress reports on its installation of a massive, nationwide network for the Department of Social Services: eight SNA networks will eventually link a variety of Amdahl mainframes and Wang minis—with not a single IBM system in sight.

Revenue figures are in millions of dollars. Each increment represents $100 million.



14

XEROX CORP.

P.O. Box 1600
Stamford, CT 06904
(203) 329-8700

Xerox Corp.'s information systems business grew 14% in 1985, stopping just shy of the $2 billion mark. According to Xerox, the growth provides proof that its oft-maligned efforts to leverage its way into the office systems business are succeeding and that its future doesn't depend totally on copiers.

The increase was due largely to strong growth in electronic printing systems, workstations, and electronic typewriters; a decline was seen in revenues from Diablo impact printers; and growth was sluggish in information processing and pc products.

Gross profit from the information systems was $679 million in 1985, up 17% from $581 million in 1984. Overall profits were up 63% to $475 million on total revenues of $8.73 billion. About $800 million of this was from discontinued operations.

Xerox began a major overhaul of its systems product line, introducing new workstations of its own design, Olivetti-built pcs, electronic printers, networking gear, and enhanced software. The company hoped the new products would reestablish momentum in the office systems market that Xerox had lost during the previous four years. Stuck with high-priced workstations to sell, Xerox had proved unable to respond to the widely accepted IBM PC.

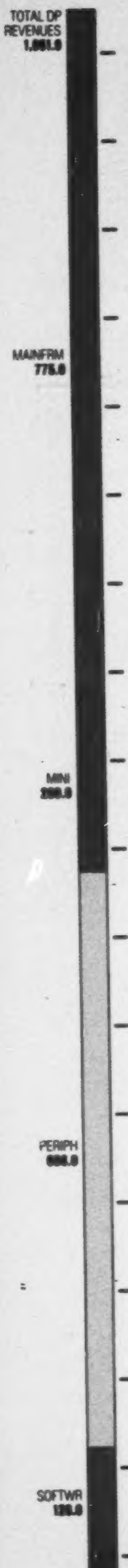
Besides revamping its products, Xerox also concentrated on marketing packaged combinations of the new products, designed to help specific corporate departments prepare and publish their documents. For instance, one package is designed to prepare technical documents; another produces catalogs and other documents in high volume. Several of the systems rely on minicomputers built by Digital Equipment Corp.

As it has been for several years, Xerox's strategy in office automation is to provide customers with a wide range of machines for preparing and producing documents. This strategy relies heavily on applying copier technology to electronic printing products and using workstation and other technologies developed at its Palo Alto research labs. Xerox is leaving traditional dp markets to IBM and other competitors, although it says it intends to make its systems communicate with IBM and DEC hosts. Meanwhile, the company continues to sell manufacturing-related computing services and to make its field service force available to other manufacturers.

Other events: the once-pioneering Shugart Associates subsidiary, which manufactures floppy disk drives, was divested; Xerox adapted its 6085 workstation to the artificial intelligence market—the company is one of three major AI-specific hardware suppliers—and continued to expand its AI software offerings; and the company teamed up with AT&T to push the latter's StarLan office network.

A major drag on corporate earnings last year was the firm's financial services division, particularly the troubled Crum & Forster insurance subsidiary, but analysts predict the division will eventually contribute to Xerox's bottom line.

Revenue figures are in millions of dollars. Each increment represents $100 million.



15

HONEYWELL INC.

Honeywell Plaza
Minneapolis, MN 55408
(612) 870-5200

Like other makers of mainframes, Honeywell Inc.'s Information Systems (HIS) unit found it hard to achieve traditional levels of growth in 1985. HIS in 1985 recorded revenues of $1.95 billion, up 6.9% from the $1.83 billion inked the previous year. The division's operating profits were $200 million, up from $180 million in 1984, and provided more than a third of the parent corporation's operating profits. The corporation as a whole showed net income for the year of $282 million, compared to $239 million in 1984. Total corporate revenues were $6.62 billion, up from $6.07 billion the previous year.

Honeywell boasted that two key performance measures both showed improvement in 1985, though neither met corporate goals. Return on investment increased to 10.6%, against a long-term goal of 14%, and return on equity grew to 11.8%, inching closer to a hoped for return of 16%.

Honeywell said it benefited from strong demand for large-scale computers, which offset a "soft" market for small machines. So soft, indeed, was the small machine market that Honeywell shuttered its Small Computer and Office Systems Group factories for four weeks during 1985 and laid off 120 workers. DATAMATION estimates that Honeywell's 1985 minicomputer revenues were off 33.3%.

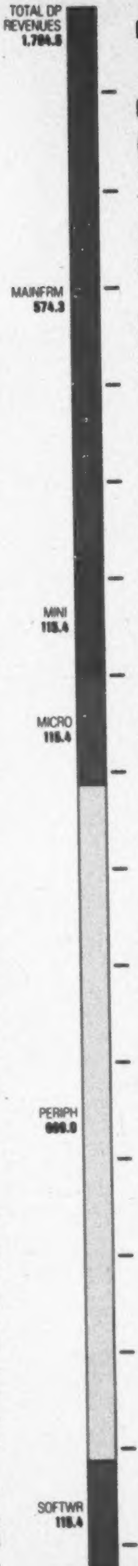
Honeywell continues to use its strength in industrial control markets to gain new computer customers. It aims to help manufacturing companies—which make up about a third of the company's customers—integrate their Honeywell factory-floor gear with Honeywell computer systems. Honeywell promises to provide a wide range of mainframe, office automation, and telecommunications products to accomplish this integration.

New integrated systems for automobile manufacture and for process control in steel mills were introduced in 1985.

The company's DPS 8/70 line of mainframes seems ripe for replacement, as does the DPS 6 line of minicomputers. Honeywell last year began winding down its support of the Multics operating system, which has not achieved nearly as wide an installed base as the GCOS system. Like most non-IBM mainframe suppliers, Honeywell has been unable to build all the products its customers need. As a result, it resells large-scale mainframes supplied by NEC in Japan and personal computers built by unidentified Japanese vendors. The NEC-built DPS 90s compete with IBM's 308X and 3090 mainframes.

Honeywell's Solid State Electronics Division began work last year on a plant in Colorado Springs, where, beginning early next year, it plans to build very high speed integrated circuits (VHSICs). Honeywell continues to participate in the military-funded VHSIC program, which is pushing semiconductor technology for aerospace, telecommunications, and military applications. Honeywell has hopes that the VHSIC project will spin off commercially applicable technologies.

Revenue figures are in millions of dollars. Each increment represents $100 million.



16

GROUPE BULL

121 Avenue de Malakoff
75116 Paris, France
(33-1) 450-29090

Bull saw red no more in 1985. For the first time since 1981, the company proudly announced a profit, honoring the pledge it had given to its principal shareholder, the French government. The company owes much of its current health to the government's investment of FF4.5 billion since 1982.

Last year Bull, which derives all its revenue from dp, pulled in $1.79 billion (FF16.1 billion), up a healthy 15.3%. Net earnings of $12.3 million (FF110.2 million), though modest, were better than expected from a company that had piled up $336 million in losses in the last three years.

Export revenues grew at a faster clip than domestic sales during 1985. The group's French revenues of $1.1 billion appear to give it about a 19% share of its home dp market, although it claims to have a 22% stake. Bull's major outside market is West Germany, which accounts for roughly 28% of foreign sales. But Bull was also busy in the rest of the world. In January Bull won a $7 million contract from the Spanish Ministry of Economy and Finance. It was the biggest order the Spanish government had ever placed for dp equipment. That was followed in April by a $6.5 million order from Chinese universities and research organizations.

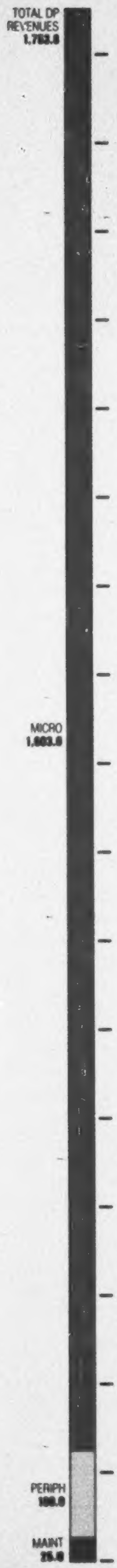
Bull's biggest domestic announcement was the top-of-the-line DPS 90 mainframe, courtesy of Japan's NEC. During the year, the French firm extended several pacts with NEC. Bull agreed to integrate NEC's System 750 mainframe into Bull's DPS 7 product line. Bull also unveiled two new DPS 88 mainframes and introduced the SPS 7, a scientific minicomputer that runs the Spix operating system based on Unix System V. The new system complements the SPS 5 mini and the SPS 9 supermini, both of which were enhanced during 1985. Improvements were also made to the DPS 4, DPS 7, and DPS 8/88 mainframes.

Continuing its policy of providing communications links between its systems and others, Bull introduced a new networking interface, the DNS C. The interface, which corresponds to the first five layers of the OSI model, connects Bull and IBM systems.

Late in '84 Bull had finally opted for IBM PC compatibility. The wisdom of this late and reluctant decision was borne out by big demand for its PC-compatible Micral 30 in 1985. The company had aimed for a 7% share of the French micro market and actually wound up with 10%. Bull has now added an AT compatible to its micro line.

Cooperation with other suppliers is a hallmark of Bull's strategy under chairman Jacques Stern. Last year Bull joined five other European manufacturers to form the X/Open Group, which will work on developing a common application software environment based upon Unix. The company also signed agreements last year with two French telecommunications companies, Jeumont-Schneider and Telic-Alcatel. The French firm is also working with Italy's Olivetti to come up with a new generation of automated banking machines.

Revenue figures are in millions of dollars. Each increment represents $100 million.



17

APPLE COMPUTER INC.

20525 Mariani Ave.
Cupertino, CA 95014
(408) 996-1010

Apple Computer Inc. finally decided to play in IBM's ballpark in 1985, a tumultuous year in which sales shrank by 7.5% compared with 75% growth the year before. Apple fell victim to a personal computer industry slowdown and, more important, to the reality that true growth lies in the corporate marketplace, where Apple is weakest. The bottom line: net income in 1985 was off 30% to $72 million.

"We're committed to building the third leg of our business," said Apple's chairman, John Sculley, last fall, explaining that the first two were the home and education markets. "To get there, we simply must have systems solutions in business and education by 1986," he added.

Some observers wonder just how Apple will fare with software houses and computer dealers. The software houses will have to develop programs to connect the 32-bit Macintosh computer to mainframes and minis, and Apple must rely on dealers to sell these networking capabilities. But it is evident the company has no other way to go if it is to survive.

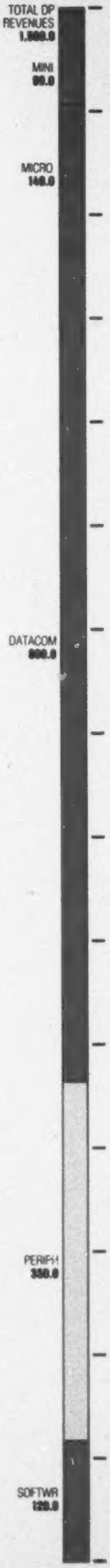
Apple recorded sales of $1.9 billion in its fiscal year 1985, which ended Sept. 28, 1985, up 27% over 1984 sales of $1.5 billion. Its net income dropped to $61 million, the lowest in four years. The company's efforts to trim costs and to reorganize attracted headlines in both the trade and popular presses as it laid off 1,200 people, chopped swollen inventories by $152.4 million to a more manageable $108.8 million, and forced the resignation of its chairman and founder, Steve Jobs. In September, shortly after the company absorbed the Macintosh division, which Jobs headed, into another group, Jobs left to form a new company, taking along some key Apple technical people. The company threatened a trade secrets lawsuit, but dropped it after Jobs agreed to allow Apple to inspect prototypes of his new company's products.

Job's departure lent needed credibility to Apple's intention to develop software that would permit the Macintosh to function in local area networks that use IBM communication standards. Sculley said the company would introduce such products sometime in 1986, but was vague as to when in 1986. In the past, Apple had promised to close the gaps in its office products line, but products were slow to emerge.

How the company will market its communications products is perplexing: it must try not to alienate its dealers while at the same time selling directly into the corporate market. Some observers think the company will do this by compensating dealers in whose territories direct sales are made.

Despite its belt-tightening, Apple has maintained a strong R&D effort. It spent $72.5 million in 1985 on research and development and intends to increase this amount by 50% in 1986. It is about to take delivery on a $4.5 million Cray Research supercomputer, the Cray X-MP. It will use the computer to simulate future products, evaluating them without having to build them.

Revenue figures are in millions of dollars. Each increment represents $100 million.



18

AT&T

550 Madison Ave.
New York, NY 10022
(212) 605-5500

From the splendid pediment of AT&T's headquarters in New York, pink granite descends to ground level: down there, the building doesn't work at all. Clumsy gray cast-iron garden furniture and huge leaden planters make pedestrian traffic difficult. People look uncomfortable here.

AT&T's dp business has been far too much like its building: lofty ambitions that don't seem to make it in the real world. It's a $34.9 billion corporation made up of an immense cash cow, hemmed in by turnaround situations. Of the computer operation, chairman Charles Brown said, it isn't going "as well as I would like to see it." Still, DATAMATION estimates AT&T's dp revenues were up 11.9% to $1.5 billion. Dp did better than the corporation as a whole, where revenues were up 5.1% to $34.9 billion. Overall profits were up 13.6% to $1.5 billion. This represented a 10.1% return on equity, half what the company has identified as its target.

The bulk of AT&T's money continues to come from telecommunications, most of it voice. Not all of this service is as profitable as AT&T would like. About 80% of the business is interstate and doing fine. But about 20% is shorter-haul intrastate: in 1984, it cost AT&T 15 cents a share to supply this service and it isn't expected to break even until this year. Also ripe for turnaround are leased private lines, producing only 3% or 4% profit.

Unix, the operating system developed at the company's Bell Laboratories, continues to be a top priority, but strategy is shifting. While vendors bring more Unix machines to market, it is no longer touted as the universal operating system. Unix is now more realistically described as a superb programming tool. In late June, the Department of Defense awarded AT&T a $946 million contract to provide, install, and maintain Unix System V computer systems.

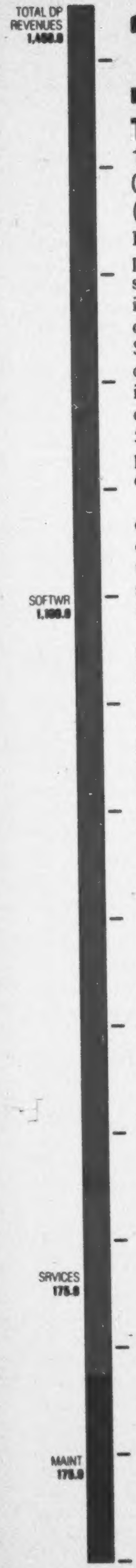
AT&T was late coming into the market for all-digital central office switches, and lost business to competitors like Northern Telecom. But by the end of 1985, almost 9 million lines of AT&T's fully digital, modular central office switch, the 5ESS, had been shipped. Another 6.5 million lines will be delivered in 1986. In Europe, the switch was chosen by the Netherlands PTT.

Also in Europe, AT&T's minicomputers were doing fairly well: in 1985, AT&T's partner Olivetti sold 1,200 of the machines. Olivetti also plans to introduce AT&T digital PBXs to the U.K. and to Italy.

In the U.S., AT&T was accused of selling its 2B and 3B computers below cost. The company denied the rumor on the one hand and did some ambitious cost-cutting on the other, announcing that 24,000 jobs would be eliminated from its Information Systems division.

Meanwhile, the best news for AT&T may have been the voiding of some parts of the federal government's Computer Inquiry II requirements: AT&T can use the same sales force for both Information Systems and Communications.

Revenue figures are in millions of dollars. Each increment represents $100 million.



19

TRW INC.

1900 Richmond Rd.
Cleveland, OH 44124
(216) 291-7000

Even a company as broadly diversified as TRW fared poorly in 1985. The Cleveland-based electronics, space, and automotive organization reported a 10% increase in revenues to $5.92 billion, but its earnings dropped precipitously: after 1984's healthy profit of $266.8 million, 1985's loss of $7.1 million looks especially sickly. Part of the problem: TRW's biggest earnings producer, the electronics and space systems operation, which accounts for 57% of revenues and 50% of operating profits, suffered an 11% drop in profits because of lower prices and cost adjustments on government contracts.

On the other hand, the company's data processing revenues were good news for TRW shareholders: they account for a little more than a quarter of total sales, and rose 31% to $1.45 billion. A huge share of these revenues were sales of software, which rose 33% to $1.1 billion in 1985.

Last year TRW spent a large chunk of its $1.5 billion in R&D money on software development, $100 million more than the year before. One result is that TRW's software productivity has doubled since 1980, according to the company's financial reports. Last year, TRW joined 12 other software using organizations to create the Software Productivity Consortium, which is a centralized research facility to streamline and improve production of aerospace software.

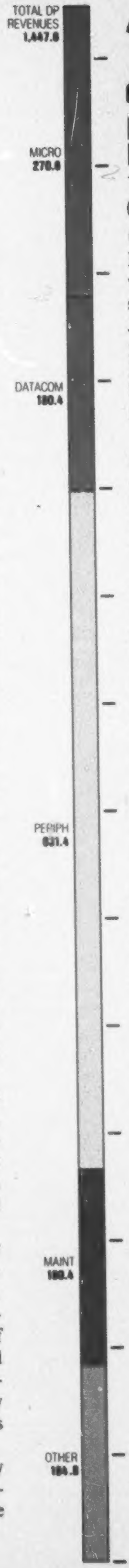
The company's computer services revenues rose $75 million to $175 million as the company made acquisitions to expand its credit reporting activities. Among the moves were acquisitions of firms that took TRW's credit reporting activities to Ohio. It also launched a service to provide commercial customers with market share data on credit accounts and added a new service for consumers called TRW Credentials. Under that plan, customers applying for loans pay a fee to get instant access to their credit files.

In the maintenance and repair business, the company reported 1985 revenues of $175 million, (compared with $150 million a year ago). In this fast-growing part of the dp business, TRW is the largest third-party player. Last year it extended this business into the repair of medical electronic equipment and the refurbishment of large mainframe computers.

The company's other major activity, the car and truck components business, accounted for 36% of the company's 1985 sales and 41% of its profit. Representing the "T" in TRW, the old Thomsen operation is one of the 10 largest independent suppliers of products for cars, trucks, buses, farm equipment, and other off-highway vehicles. In 1985, following the acquisition of North American facilities operated by Firestone Tire and Rubber, it became the world's largest independent supplier of seat belts.

As to the shareholders mentioned above, by the end of 1985 there were fewer of them: the company bought back 21% of its common stock, or some 7.7 million shares.

Revenue figures are in millions of dollars. Each increment represents $100 million.



20

MATSUSHITA ELECTRIC INDUSTRIAL CO. LTD.

1006 Kadoma, Kadoma City
Osaka 571, Japan
(81-6) 908-1121

Matsushita Electric Industrial Co. Ltd. (MEI), the world's largest consumer electronics company, is staking a good part of its future on data processing. Judging from the company's dp performance last year, that may be a wise bet. In 1985 Matsushita Electric's dp revenues rose an estimated 30% to $1.4 billion (¥344 billion). As a result, dp now accounts for 6.8% of total corporate revenues.

Over the last few years, MEI's production prowess has brought Big Blue to MEI's door. The Japanese firm has several big oem contracts with IBM for floppy disk drives and terminal equipment. MEI produces IBM Japan's JX personal computer and various components for the 5500 workstations.

Matsushita hopes to double its office automation sales over the next three years by beefing up software. It is already the world's largest producer of facsimile machines. Last year MEI jointly developed with Peking University a desktop Chinese language word processor. The new unit, called the Panaword Handwritten Character Processor, uses a new and faster input technique pioneered by the university.

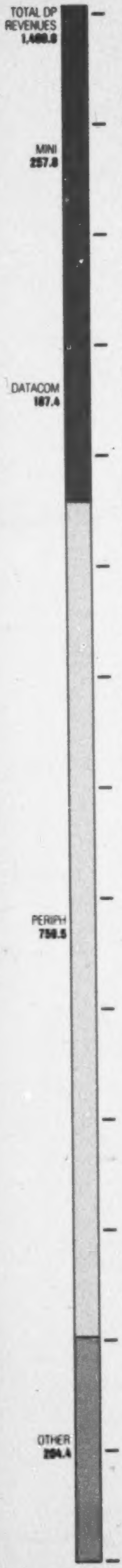
Matsushita is also Japan's leading maker of industrial robots. MEI devotes about half of its total computer assisted manufacturing development to in-house sales. But outside sales of industrial robots were up an estimated 30% to $184.4 million (¥44 billion) in 1985.

Sales of personal computers and peripherals slowed down during the year. MEI produces floppy disk drives at its Matsushita Communications subsidiary. Matsushita had accounted for roughly 15% of total Japanese shipments of floppies when production peaked back in 1984.

Earlier this year Matsushita signed two big marketing deals with U.S. companies. In January, MEI finalized a pact that will enable it to sell Harris equipment in the Far East. A month later the company's trading and marketing arm, Matsushita Electric Trading Co., signed an agreement to sell Sequent Computer Systems' superminis in Japan. The Japanese will initially market the Oregon firm's Balance 8000 line of parallel processing machines. The Sequent wares will be sold through the affiliated Matsubo Equipment & Instrument Corp. MEI also has an agreement to market in Japan the Transputer, the parallel processor developed by Britain's Inmos. In another deal, when Shugart stopped ordering disk drives, Matsushita turned around and bought the ailing company from Xerox.

Matsushita actively participates in dp research efforts sponsored by the Japanese government. It is one of the eight Japanese corporations involved in the Ministry for International Trade & Industry's (MITI) Institute for New Generation Computer Technology. Matsushita engineers are also participating in a research consortium in western Japan that hopes to come up with artifical intelligence applications in consumer electronics.

Revenue figures are in millions of dollars. Each increment represents $100 million.



21

TOSHIBA CORP.

1-1 Shibaura 1-Chome
Minato-ku, Tokyo 105, Japan
(81-3) 457-2105

Last year was a time of tie-ups and takeovers for Toshiba, alliances and acquisitions that helped the energy and electronics conglomerate weather the 1985 slump in semiconductors and the growing value of the yen. DATAMATION estimates that Toshiba's 1985 dp revenues shot up 30%. The company had dp revenues of $1.4 billion (¥335.4 billion), roughly 10% of total corporate revenues.

Last year an agreement with Olivetti gave Toshiba a 20% equity stake in the Italian company's Japanese subsidiary. The deal should secure Toshiba's position as an oem supplier of peripherals and semiconductors to Olivetti's European and Japanese operations. The company's communications capabilities were also beefed up through its ongoing collaboration with AT&T, which has a 25% interest in Olivetti. Under a var agreement, Toshiba markets a Japanese adaptation of AT&T's Datakit virtual circuit switch in Japan.

The Japanese telecom deregulation drive that got under way in April 1985 will open up new communications opportunities for high-tech companies. Toshiba plans to pursue those opportunities within a web of oem arrangements. One of them is with ITT, which granted Toshiba exclusive local marketing rights for its DPS1500 packet switching systems.

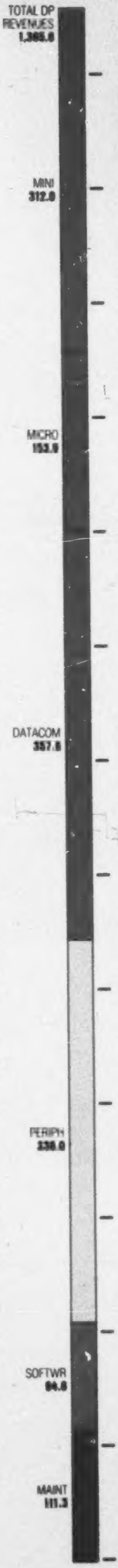
On the hardware side, Toshiba linked up with Sun Microsystems in the States. In the first stage of the agreement, Toshiba will import 1,200 of Sun's engineering workstations that it will use internally for developing software, CAD systems, and networking technology. Toshiba, which will connect the workstations to its minicomputers and peripherals, is tailoring the terminals to the local market by adding a Japanese-based Unix operating system.

Toshiba strengthened its micro line when it took a majority stake in the struggling micro maker, Sord Computer, which was folded into Toshiba's pc division. The deal may help Toshiba move up into the more lucrative 16-bit business computer market now dominated in Japan by NEC, Fujitsu, and IBM.

For its peripherals group, Toshiba clinched an oem contract to supply IBM with one million 3½-inch floppy disk drives for the PC AT. The company also won a slew of oem contracts for hard-disk drives and for its dot matrix and nonimpact color printers. Its Tokyo Electric subsidiary is one of Japan's leading manufacturers of low-end dot matrix printers. Sales of optical disk files nearly doubled due to orders from Japanese government agencies replacing their mag disk media last year. Facsimile sales increased about 20% in 1985, more than 80% of those revenues coming from the home market.

Last year the company, which has less than 8% of the local minicomputer market, introduced the Tosbac G8050 32-bit supermini to bolster its industrial process control business. In the Japanese small business computer market, Toshiba offers a series of minis that are being sold by its restructured office automation marketing group.

Revenue figures are in millions of dollars. Each increment represents $100 million.



22

N.V. PHILIPS GLOEILAMPENFABRIEKEN

5621 BA Eindhoven
The Netherlands
(31-40) 783496

Last year was one of strategic importance for 95-year-old Philips. On June 1, 1985, the electronics giant officially merged its dp and business communications interests into a new group, the Telecommunications & Data Systems Division. The division provided the bulk of Philips' $1.36 billion (G4.5 billion) worldwide dp revenues, up 13% in local currency.

What happens quickly on paper can take a long time in practice, especially in a company with strong corporate traditions. "I would like to have the integration of the two divisions complete by the end of 1986," said Telecommunications & Data Systems Division chief Gert Bindels, "but that doesn't mean it will all work." What is working is the corporate cause that unites the two groups—Sophomation. Announced in 1983, this strategic product line is based upon wide area and local area networks, a digital PBX, software, processors, and terminals. Last year Sophomation products brought in 20% of the company's dp revenues.

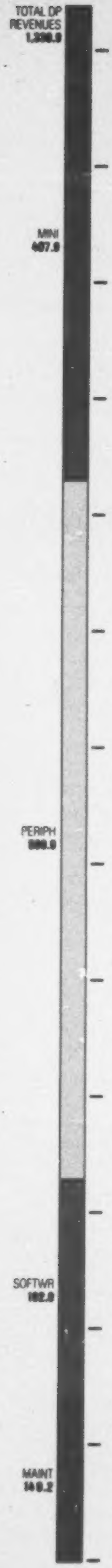
Sophomation is significant for Philips' customers because it provides a way to combine the company's disparate, and often incompatible, product lines. As Hilde Uhler, a consultant in the West German office of market researcher Dataquest, points out, "Philips has an incredible amount of work to do on its old product lines. Sophomation looks as if it is all tied together, but there are still a lot of loose ends." Even so, Philips has already tied a couple of marketing knots for Sophomation. Harris Corp. in the U.S. and Kyocera Corp. in Japan have both incorporated the Sophonet wide area network into their product lines.

In the States, Philips is looking for purchases rather than partnerships to bolster its slumping American operations. "U.S. business was lousy in 1985," admits Bindels. "We have little more than a wp operation there right now." Philips' U.S. subsidiary went through a shake-up last year when manufacturing was moved to a new plant in Montreal, the work force was cut by 150 people, sales offices were closed, and a new U.S. chief, ex-Burroughs U.K. manager Laurie Rushton, was appointed.

Philips also has pressing problems closer to home. Its microcomputer sales are poor and its minicomputer wares need updating. A member of the X/Open Group of European Unix supporters, Philips has not been as strong an advocate of the operating system as users had expected.

On the plus side, Philips has launched a number of innovative projects that could boost its dp operation. A pioneer in optical storage technology, the Dutch company is finally beginning to turn its ideas into revenues through a joint venture company with Control Data. It also has development deals with Digital Equipment for imaging systems, with West Germany's Siemens for production of a 1MB chip, and with France's Bull for smart cards, which are plastic cards with embedded microprocessors.

Revenue figures are in millions of dollars. Each increment represents $100 million.



23

NIXDORF COMPUTER AG

Furstenallee 7
4790 Paderborn, West Germany
(49-5251) 3000

Heinz Nixdorf, the founder and chairman of Nixdorf Computer, died suddenly at the Hannover Fair in March this year; his legacy is a company that is in fine shape for the future. In 1985, Nixdorf revenues grew by 20% in local currency to DM3.2 billion, by 16.7% in dollars to $1.34 billion. Nixdorf Computer has become one of Europe's few truly international dp firms: export revenues were up by 20% to $677 million, just over 50% of total sales.

Back home in West Germany, business was also strong, with sales up 21%, confirming Nixdorf's position as the country's third largest dp supplier, behind IBM and Siemens. Customers have responded particularly well to the company's new telecommunications product strategy, introduced in the early '80s; a 1985 high point was the thousandth installation of its digital PBX, the 8818. Sales of the company's digital telephone handset also improved last year.

Even so, traditional dp still remains the most important business for Nixdorf, and the company continued to expand and update its dp product range in 1985. Targeting the technical and scientific market, Nixdorf unveiled the Targon/32 mini, originally developed by Auragen Systems, and the new RISC-based Targon/35 supermini, built by Pyramid Technology, in which Nixdorf has an equity stake. These systems are aimed primarily at CAD/CAM applications running under Unix, and Nixdorf is working with other U.S. and European vendors in the European X/Open Unix group to further commercialize the operating system.

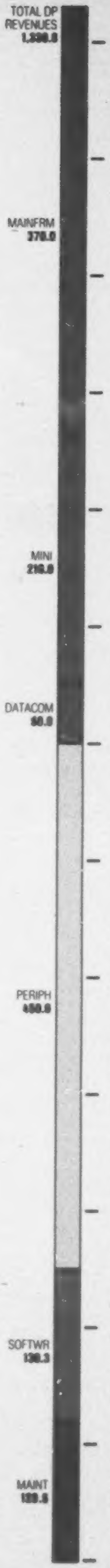
Meanwhile, Nixdorf took another step toward IBM compatibility last year with its upgrades for the flagship 8890 series of small mainframes. The new models have a capacity of between 1.3MIPS and 2.8MIPS and are based on Hitachi machines from that company's West German marketing agent, BASF.

Nixdorf also added new peripherals and software including TWAICE, an expert systems shell that the company developed in-house and uses for fault diagnosis. AI was one focus of the company's research last year, along with integrated workstations, new telecom products, and vertical market software for the finance, automobile, and engineering sectors.

Investment and staffing levels rose in all areas. R&D funding was increased by 18% to cover new projects. Capital expenditure went up by 12% and the number of employees rose by a substantial 3,100, giving the company a total work force of 23,280.

Nixdorf had put part of its equity on the open market for the first time in 1984. More of the company's equity is likely to be sold off this year to fund expansion and product development, a task that now falls to Nixdorf's new chief executive, Klaus Luft. Groomed by Heinz Nixdorf as his successor, Luft has been with the company for many years. He's an amiable and shrewd marketing man, and though Nixdorf will be a tough act to follow, last year's strong performance gets Luft off to a good start.

Revenue figures are in millions of dollars. Each increment represents $100 million.



24

STC PLC

10 Maltravers St.
London WC2R 3HA, England
(44-1) 836-8055

STC's decision to buy ICL two years ago may have been the best move the British company ever made. ICL, which recovered from its own financial crisis several years ago, was the only STC subsidiary that showed a profit in 1985. More than 50% of STC's revenues of $2.5 billion (£1.9 billion) were contributed by ICL. Dp revenues were $1.3 billion (£1.03 billion), a hefty sum but not substantial enough to put STC in the black: corporate losses were $69 million (£53.8 million) for the year.

STC's financial woes put pressure upon the company's charismatic chairman and chief executive Sir Kenneth Corfield to resign. Corfield, who had been the main architect of the ICL takeover plan, was replaced by Lord Keith of Castleacre. Robb Wilmot, the former managing director of ICL, also left. Wilmot, who had played a major role in rescuing ICL, severed all connections with STC at Christmastime to concentrate on his new chip company, European Silicon Structures.

Wilmot and Corfield were not the only people to go. STC trimmed its staff by 3,000 and moved into a smaller head office. In other cost-cutting moves, the company sold off various subsidiaries that were deemed marginal to its core businesses. One sell-off was IAL Gemini, a joint venture with Cap Gemini Sogeti. The blues got so bad for STC that there was even talk of a takeover bid from British Telecom (BT), a major customer for STC's optical fibers and other telephone transmission equipment.

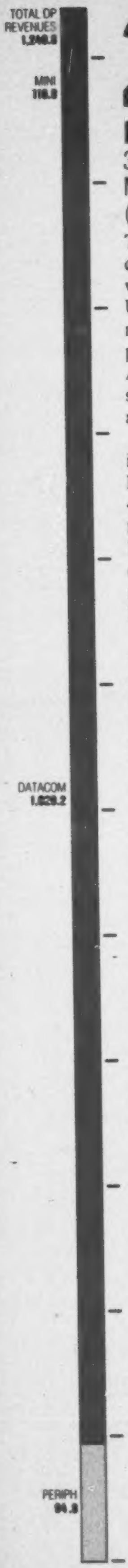
The newcomers at the top of STC are pinning their hopes for recovery on information systems. STC Network Systems, a joint company with ICL, has already been set up and the firm is forming another joint venture to tackle defense markets.

The news from the U.S. was bleak: ICL closed manufacturing operations, laying off 300 workers at its Utica, N.Y., plant. There was better news in Britain, where ICL won a $9.6 million contract to supply BT with its One-Per-Desk voice/data workstation. Telecom Australia also ordered $5.4 million worth of the workstations.

The pivotal products of 1985, however, were the Series 39 mainframes, built with the help of Fujitsu of Japan. Announced in April, there were $150 million worth of orders within six months. At the low end, ICL introduced Quattro, a multi-user micro that runs Concurrent CP/M, and Clan, a Unix-based microcomputer, in its home market.

A Unix supporter, ICL joined the X/Open Group, a consortium of European dp companies that plans to develop a common application software environment based on the AT&T operating system. The firm is also participating in the British government's Alvey R&D project. Such collaborations are fine to a point, say British observers, who believe that for ICL, cooperation should begin at home—with STC. The twosome have yet to prove they can combine their computer and communications capabilities to come up with competitive products.

Revenue figures are in millions of dollars. Each increment represents $100 million.



25

NORTHERN TELECOM LTD.

33 City Center Dr.
Mississauga, ONT L5B 3A2
(416) 275-0960

The Canadian telecommunications equipment giant continued to grow nicely in 1985: corporate revenues were up 24%, to $4.25 billion from $3.42 billion in U.S. dollars. Net profits increased by 11%, to $275 million from $247.7 million. Northern Telecom said price reductions to meet increased competition—AT&T is finally selling an all-digital central office switch—and the cost of introducing new products and features have held down profit growth.

NT reported record revenues in all its geographic markets, with the U.S. once again representing the largest part of its growth in 1985. U.S. revenues rose 40% to $2.9 billion, or 69.7% of total revenues. (Reflecting this market reality, beginning in 1986, Northern Telecom will issue financial reports in U.S. dollars.) Revenues generated outside North America remained at 4% of total revenues and, at $175.9 million, were up 38% from 1984.

Northern continued to push OA products even though its 1985 performance in the office did not match its success in telecommunications. Dp revenues for the integrated business systems and terminals product line were $1.24 billion, up 14% from $1.17 billion a year earlier. The Meridian DV-1 Data Voice System, introduced late in the year, had nonetheless sold several hundred units by year-end.

The company continued to be a market leader in PBXs in 1985, shipping 1.4 million lines of Meridian SL-1 and Meridian SL-100 during the year, a 27% increase over the previous year's 1.1 million lines.

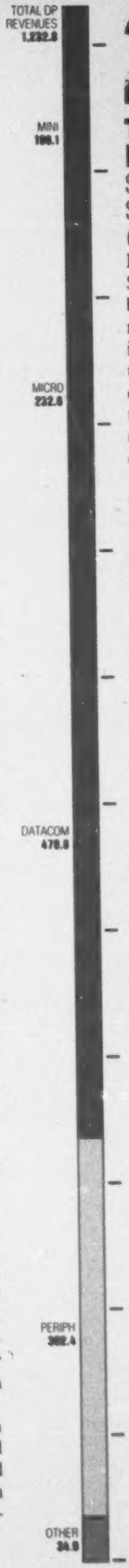
Much of Northern Telecom's success has come from its fully digital central office switches. Worldwide, no other vendor has installed as many, and central office switches continued to be the most important of the corporation's products in 1985, with revenues increasing 55% from 1984 to $2.1 billion U.S. dollars, or 50% of total revenue. The firm captured a lucrative and widely publicized export contract with Nippon Telegraph and Telephone Corp. (NTT) of Japan to supply central office switching equipment in the world's second largest market for telecommunications equipment.

NT has supplied telecommunications equipment to all 22 of the Bell Operating Companies (BOCs), and, in 1985, signed agreements valued at nearly $1 billion with BellSouth, NYNEX, Southwestern Bell, and Pacific Northwest Bell.

In response to slowing growth in the telecommunications market, NT continued to invest heavily in R&D, with expenditures up 36% to $427.9 million. It completed a new $25 million headquarters building in Nashville and built two new plants, one near North Carolina's Research Triangle and one in Santa Clara.

Edmund B. Fitzgerald was named chairman in 1985, succeeding Walter F. Light, who resigned after a decade as president, ceo, and chairman. David G. Vice was named president. He will also serve on the board, as will Bowie K. Kuhn, the former baseball commissioner.

Revenue figures are in millions of dollars. Each increment represents $100 million.



26

TELEFONAKTIEBOLAGET LM ERICSSON

S-126 25
Stockholm, Sweden
(46-8) 752-0000

Ericsson showed a 45% drop in pretax profits to $114 million, despite dp revenues having increased by 10% to $1.23 billion (Skr10.6 billion). Management put most of the blame on the unsuccessful U.S. introduction of communications and computer products. LM Ericsson, one of the world's four largest telecommuncations equipment companies, had thought that good technology, a deal with Atlantic Richfield (Arco), and some imported Swedish managers would do the trick in the U.S. Today, they know better.

The two most visible signs of the changing times are American managers in almost all top spots in the U.S. and the end of formal cooperation with Arco. Swedes Hakan Ledin, former president of Ericsson Inc., and Gundor Rensch, former head of Ericsson Information Systems (EIS-USA), were replaced by American executives. Headquarters were moved from international New York to heartland Dallas. The emphasis in the U.S. is now limited to two products: the MD-110 PBX and the public exchange AXE, neither of which has significantly cracked the market.

In the computer marketplace Ericsson has changed strategy and become a company with a European focus. After severe losses in both 1984 and 1985, this was a necessity. After losing $23 million in 1984, and $119 million last year, EIS president Stig Larsson ordered major cutbacks to reduce costs—and worldwide marketing costs barrels of money.

Larsson is the third president of EIS in three years. He was put on the hot seat in the beginning of 1985, when things looked very poor, and at that point he started by stabilizing the products. In an effort to make money fast, EIS had delivered merchandise without testing it adequately. Three hundred of the MD 110 PBXs were already installed when a major walkthrough uncovered some 3,000 software errors. The same thing, on a smaller scale, happened with the new banking terminal generation. It took EIS the best part of 1985 to get rid of these problems.

Larsson seems able to cope. He claims 1986 will be a breakeven year, and figures the firm will be in the black again in 1987. Save some major disaster, he is probably right. But EIS is changing in the process from a supplier of systems to a manufacturer of boxes, albeit boxes of high ergonomic quality.

EIS is now organized into three independent divisions: one for communications systems, in other words the MD 110; another for computer equipment, selling the pcs and Alfaskop banking terminals; and a third for office equipment—mostly with the Facit label—typewriters, furniture, and peripherals. Each division has complete responsibilty for its products, from production to marketing to installation and service. This is an important change for Ericsson, which is used to a matrix organization, common factories, and decision-making by staffs.

At last, EIS seems to have the strong management the company has lacked since it began in 1981.

Revenue figures are in millions of dollars. Each increment represents $100 million.

27

TANDY CORP.

1800 One Tandy Center
Fort Worth, TX 76102
(817) 390-3700

Tandy Corp.'s revenues staged a remarkable recovery late in 1985, but the big electronics retailer's income ran behind the previous year's performance. Still, the company was predicting a sales growth rate of 15% a year for the next several years. And its chairman, John V. Roach, predicted a 30% increase in income for the fiscal year that ends this month. (That would follow an earnings drop of about the same rate in the last fiscal year.)

Tandy, which operates 5,000 retail electronics stores, recorded 1985 revenues of $3.13 billion, an increase of $331 million over 1984. Its income of $203.9 million dropped 12.8% from 1984's $234 million. The company began to gain momentum in the second half of 1985, and chalked up its first billion-dollar quarter at the end of the year. Dp revenues for the year were up a solid 28.7%, hitting $1.2 billion despite sharp price-cutting throughout the microcomputer business.

Much of the good news at Tandy was due to its Model 1000 computer, compatible with IBM's PC but substantially cheaper at the time of its introduction last year. Some reports said Tandy was selling from 7,000 to 10,000 Model 1000s a month, and by early fall, Roach was predicting the Model 1000 would be the "most popular PC-compatible computer in the marketplace." Early deliveries of the Model 3000, which is compatible with IBM's advanced technology (AT) models, were also cheering, the company reported. The Model 3000, introduced in November, is priced between $2,600 and $3,600 depending on the amount of disk memory—or about $3,000 below what IBM was charging for its machines. Tandy promoted the Model 3000 as working faster and more easily expandable than the AT. The Model 3000 is the final transition of the company's previously incompatible 16-bit machines to IBM compatibility, a transition that the company thinks will make it a viable long-term participant in microcomputers. Although sales at its 431 computer stores have been increasing since late last summer, Tandy still says it foresees "many uncertainties" in the microcomputer business this year.

Tandy, which is the number one company in the $34 billion retail electronics market, operates many manufacturing operations overseas—in Japan, Korea, and Taiwan—and last spring signed agreements to open personal computer manufacturing plants in Mexico. Sales overseas account for about 7% of Tandy's gross, with computers supplying 40% of foreign revenues. While sales measured in local European currencies increased, the strength of the dollar caused losses in the European market.

The company this year began a remodeling of its Radio Shack stores, introducing brighter color schemes and sleeker displays in an effort to present "the technology store" image, according to Roach. More than 500 stores will get the make-over treatment in 1986, and all the Radio Shack stores are scheduled to be remodeled within five years.

Revenue figures are in millions of dollars. Each increment represents $100 million.

28

DATA GENERAL CORP.

4400 Computer Dr.
Westboro, MA 01580
(617) 366-8911

The year 1985 was a roller-coaster one for Data General: it began joyously at the heights but quickly plunged to the depths. The company began its fiscal year, the final quarter of calendar '84, with a near 40% leap in sales, but then a totally unexpected slump in demand for the minimaker's products led to a year-long sequential decline in sales and profits in calendar '85. Total revenue for the year shrank 4.3% to $1.2 billion, and because the company's resources and expectations were geared for a repeat of its stellar performance in 1984, DG's net profit dived 70.8% to $24.3 million. After the March quarter, the company spent the remainder of the year scaling down its costs, attempting to balance them with real demand. The most severe of its corrective measures was its first companywide firings in June: worldwide employment was cut by 6.5%.

Data General, more than any other minicomputer company, was a victim of last year's sickly domestic economy. The company's above average dependence on industrial oems and its relative lack of new products left it peculiarly vulnerable to environmental forces. Even overseas, where the overall economy remained stronger, the company's poor product cycle led to growth levels well below that of its major competitors. DG's fiscal growth in international markets was 16%, almost 10% less than Digital and 24% below Prime.

Unlike DEC and Prime, which began to ship new high-end processors in the March quarter, Data General's "biggest announcement to date" did not come until the year's end—too late to boost earnings, but a "seed" for future growth. It was apparent that, with its 5.5MIPS and 10MIPS general purpose superminis, the new MV 20000 Models 1 and 2, priced at $34,000/MIPS and $42,000/MIPS respectively (i.e., almost half the cost of comparable VAX 8600s from DEC), the company is hoping to power its way out of its difficulties by offering products and pricing its customers simply can't refuse. Even at the lower end, a new departmental MV 2000 and engineering workstation were described as having price/performance characteristics "unrivaled in the industry."

DG's transition from blue-collar to white-collar marketing, spearheaded by the success of its CEO office automation software, has left many of its traditional technical and engineering customers out in the cold and hurt sales. As a result DG is pinning its hopes on new software that bridges "white" and "blue" camps, creating greater corporatewide integration. Its first offering, known as TEO (Technical Electronic Office), weds CEO's functions to factory, engineering, and laboratory computers and allows technical workers to integrate all aspects of their work.

Data General's president Edson de Castro admits to two blunders: underestimating demand in 1984 and overestimating demand last year. Maybe, with a bagful of new products and a kinder economic environment, the company will get it right in 1986.

Revenue figures are in millions of dollars. Each increment represents $100 million.

29

GENERAL ELECTRIC CO.

3135 Easton Turnpike
Fairfield, CT 06431
(203) 852-8200

History buffs will no doubt recall that once, before they sold out to Univac and Honeywell, both RCA and GE were in the computer business. Now they are the same company. The merger was approved by RCA stockholders in February 1986.

And although GE recorded only a 1% increase in sales—to $28.28 billion in 1985 from $27.95 billion in 1984—enthusiasm about the merger helped maintain GE's good rep on Wall Street. Net income rose a very modest 2%, to $2.33 billion from $2.28 billion.

The company's dp operations shone brighter, with revenues reaching $1.13 billion, 19.5% over 1984. Amid the turmoil of restructuring and refocusing, General Electric Information Services Co. (GEISCO) had revenues of $950 million, 15% over 1984.

The operator of the world's largest commercially available teleprocessing network was busy on both the hardware and software fronts. The two-pronged attack was part of GEISCO's refocusing its business direction to offer specific business network applications delivered through its network to targeted markets. The company signed an agreement that establishes NEC as a distributor of GEISCO's teleprocessing services in Japan.

At its computer supercenters in Cleveland and Amstelveen, the Netherlands, the company replaced 35 Honeywell DPS 870 mainframes with 11 top-of-the-line DPS 90s, built by NEC in Japan. This was part of a $66 million equipment upgrading and modernization program.

New software offerings for IBM mainframe users included 3270 SNA/SDLC access to GEISCO's Mark 3000 IBM-based service and to its Mark*Net Value Added Network Service. It also announced support of IBM's VM/CMS system as part of its MARK 3000 service and 3270 bisynchronous service through Mark*Net.

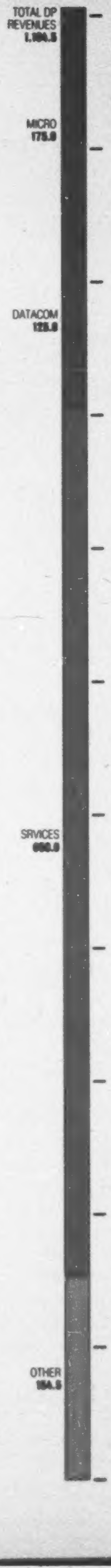
GEISCO introduced the EDI*Express system, designed to provide the electronic exchange of business documents among trading partners. The company extended EDI to the health care industry by forming the EMC*Express, which electronically collects and distributes medical claims.

One pleasant surprise was the success of GEnie, GEISCO's network for personal computer users. Created to exploit empty nonprime-time hours on GEISCO's network, GEnie has come out of the bottle with a vengeance.

Refocusing was not without its price. A reduction in force in May idled 400 workers.

"Those reductions were due to realigning costs to maintain our profitability," said spokesperson Ruann Pengov. "We made the last step in the transition we've been going through in the last two or three years. Even though we have a tremendous network, we're focusing on applications that will bring value added. We've gone from technology driven to market driven."

Revenue figures are in millions of dollars. Each increment represents $100 million.



30

MCDONNELL DOUGLAS CORP.

P.O. Box 516
St. Louis, MO 63166
(314) 232-0232

McDonnell Douglas Corp.'s sales went up 18.7% in 1985, from 1984's $9.66 billion to $11.48 billion; corporate earnings didn't match the pace, rising only 6%, to $345.7 million from $325.3 million.

The aircraft giant's Information Systems Group had a lot to do with this disparity. ISG had revenues for the year of $1.10 billion—up 12.3% over 1984—but managed to lose $109.3 million; in 1984 ISG had lost $48.7 million. So far, the chances of ISG hitting its goal of $4 billion in revenues and $400 million in profits by 1990 don't look great. But not all the news was bad: McDonnell Douglas Manufacturing and Engineering Systems had revenue growth of more than 40% in CAD/CAM business and McDonnell Douglas Network Systems achieved growth of almost 30% in its Tymnet data communications network business.

The general slowdown in the computer services business hit while ISG was in the midst of a reorganization, combining and rearranging elements of what formerly were McAuto, Microdata, and Tymshare. In the process, it dropped two activities: McDonnell Douglas Distribution Systems Co. was folded and Unitax was sold.

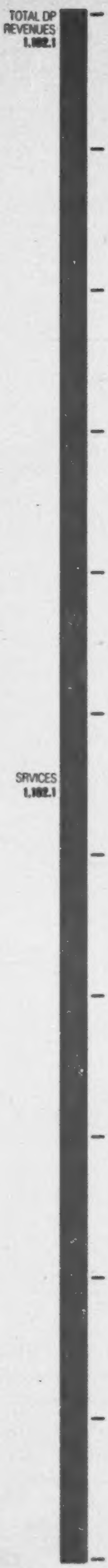
Currently ISG includes McDonnell Douglas Health Systems Co., McDonnell Douglas Manufacturing and Engineering Systems Co., McDonnell Douglas Network Systems Co., McDonnell Douglas Payment Systems Co., McDonnell Douglas Computer Systems Co., McDonnell Douglas Diversified Information Systems Co., McDonnell Douglas Field Service Co., McDonnell Douglas Information Systems International, and McAuto Systems Group Inc. These nine companies comprise 21 separate operating units.

In the third quarter, the company said it was taking measures to cut costs and increase revenues; as a result, a small profit was announced in December, but this was before amortization of $65.1 million in acquisition costs. ISG also acted, late in the year, to curtail new product development, particularly in the financial services area.

One area where ISG still has plans for growth in '86 is the Diversified Information Systems Co. The company offers services to a number of vertical industries in which operations to date are limited. ISG, however, hopes several of the industries may someday prove lucrative enough to warrant full company status for the units serving them.

Nevertheless, the rhetoric issuing from ISG headquarters wasn't about growth, it was about hanging on in tougher times: "The group is limiting its expansion into some markets and cutting back or eliminating some product lines, and central staff costs have been significantly reduced. Some staff functions are being decentralized to give individual businesses more direct control over costs. Such actions, combined with the fact that ISG has entered the year with a stable organizational structure, should position the group for improved results in 1986."

Revenue figures are in millions of dollars. Each increment represents $100 million.



31

AUTOMATIC DATA PROCESSING INC.

One ADP Blvd.
Roseland, NJ 07068
(201) 994-5000

Last year, posting its 36th consecutive year of rising revenues and earnings, ADP passed the $1 billion mark, the only computer services company to reach that milestone.

ADP's main business hasn't changed much over the years. Employer Services, the payroll and tax filing unit, one of seven divisions and ADP's oldest and largest business, grew to represent about 45% of the company's revenues, up from about 40% in 1984. Revenues themselves hit $1.10 billion, up 14.8% from 1984's $959.4 million; and net income was up 20% to $95.3 million from $79.4 million in 1984.

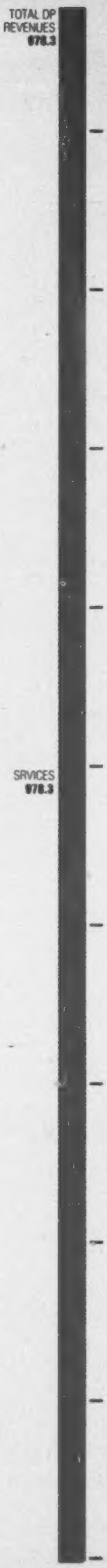
Major initiatives in Employer Services in 1985 included the formation of a National Accounts Division to target companies with over 500 employees and an interactive personnel and payroll service.

Brokerage Services is ADP's second largest business, representing about 20% of the company overall. Last year, ADP announced it was acquiring Allied Signal's Bunker Ramo Information Systems business, a transaction completed in February at a net cost of about $40 million. The BR purchase follows the acquisition of GTE Telenet's brokerage service business in 1983. The purchases signal ADP's move into the front offices of brokerage houses after more than 20 years of being a force in back offices. In June, ADP acquired CDC's Brokerage Transaction Services Division, which provides back office transaction processing and record keeping. The Accounting and Dealer Services Divisions each account for about 10% of ADP's business. The remote processing mode of delivering the accounting service slowly declined, but the newer interactive delivery mode picked up, particularly in client-site computer placements. ADP introduced the PC Connection, which enables an ADP client using an IBM or compatible micro to interface to ADP minicomputers. Last year, ADP acquired ROI, Minneapolis, which sells an integrated manufacturing accounting system. Dealer Services had strong growth due to an improved automotive market and new product introductions.

Each of ADP's other divisions—Collision Estimating Services, Network Services, and Banking Services—accounts for 5% or less of ADP's overall business. Within Collision Services, which had very strong growth, ADP is working on Atlas, a system designed to enable insurance adjusters to cite a few key aspects of a damaged vehicle in order to make a decision on whether to repair or replace it. ADP hopes to have the service available this year. In May, ADP acquired Automotive Information Systems, which provides used car valuation services. Network Services revenue declined but remains profitable. The ATM service in the banking division is in the black but growing less rapidly than ADP thought it would. Accordingly, the company has scaled back its sales efforts to small sites and medium-sized institutions.

In the financial area, ADP raised $100 million in a debenture offering.

Revenue figures are in millions of dollars. Each increment represents $100 million.



32

GENERAL MOTORS CORP.

3044 General Motors Blvd.
Dearborn, MI 48202
(313) 556-5000

In 1984 GM swallowed Electronic Data Systems (EDS) for a mere $2.5 billion. In 1985 it gulped down Hughes Aircraft Co., the electronics and components wizard, lust for which engendered some hot bidding before GM edged out Ford and Boeing. Hughes cost twice as much as EDS, but what's $5 billion when your sales are $96.4 billion, the highest in the company's history, and your net income of $4 billion is the second highest in your history? Hughes instantly made GM the number one defense electronics concern in the U.S.

Hughes, like EDS, will retain its separate identity under the umbrella—along with Delco Electronics Corp.—of GM Hughes Electronics Corp. Based on its 1985 sales, GMHE ranks among the top 40 U.S. industrial companies.

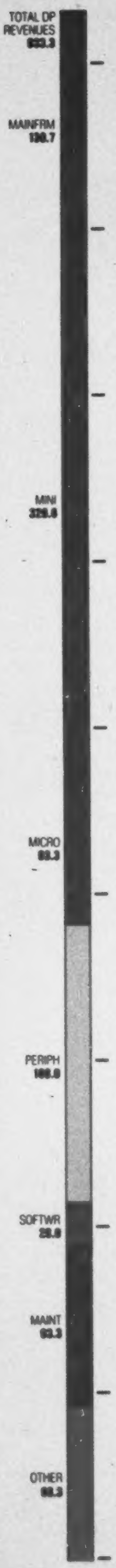
While Hughes got all the ink, EDS got all the money. Even leaving aside the huge $2.36 billion billed to internal GM business, EDS's revenues increased 24%, from $786.1 million to $978.3 million. (Dp revenues in the DATAMATION 100 do not include revenues stemming from sales by one unit of a company to another.) EDS's net income soared 135%, from $80.7 million to $189.8 million, although after an accounting change net income was reduced by $49.8 million.

Internationally, EDS's non-GM business more than doubled, the biggest new piece being a facilities management contract with Unilever. Under the contract, considered to be the largest of its kind in Europe, EDS will assume responsibility for the data processing and communications services required by the joint head offices of Unilever PLC in London and Unilever Netherland BV in Rotterdam. EDS was also awarded a five-year systems integration contract by the Flemish Ministry of Education of the Belgian government. EDS bought Swedish software company Datema and tried unsuccessfully to take over British software house Logica PLC.

In the U.S., EDS landed several large federal and state government contracts, including a 10-year, $200 million office automation agreement with the U.S. Department of Agriculture and a seven-year, $45 million integrated office automation contract with the U.S. Customs Service. In the private sector, EDS signed a 10-year, $260 million facilities management agreement with Western Union and a contract to provide corporatewide support of AT&T information processing and marketing activities.

There were some bumps on the road to MAP (manufacturing automation protocol), notably technical difficulties at the Autofact demonstration, where 21 companies talked to each other on 802.4 and 802.3 networks. But heretofore reluctant vendors replaced words with action, and several new products were announced at each of the four MAP user group meetings. Office compatibility was also looking more promising, as MAP's office counterpart, the technical/office protocol (TOP), got off to a good start when Boeing signed on.

Revenue figures are in millions of dollars. Each increment represents $100 million.



33

MITSUBISHI ELECTRIC CORP.

2-2-3 Marunouchi
Chiyoda-ku, Tokyo 100, Japan
(81-3) 218-2171

Heavy reliance on oem agreements has nearly always made Mitsubishi Electric (MELCO) a low-profile player in the computer arena. Only when there's been trouble with foreign firms like IBM or Tandon has the company felt the warmth of the public spotlight. Nevertheless, the company's estimated 1985 dp revenues of $933.3 million (¥222 billion) are hardly obscure. Net corporate income still plummeted an estimated 10.4%, underscoring the need for further diversification of the company's dp offerings.

Oeming microcomputers has given MELCO management a few headaches over the last two years. One migraine hit at the end of '84, when one of its micro customers, Leading Edge Products Inc. in Canton, Mass., slapped the company with a breach of contract suit. MELCO immediately countersued Leading Edge in a Los Angeles court over delinquent payments. So, when Leading Edge switched to Korean supplier Daewoo, few tears were shed at MELCO.

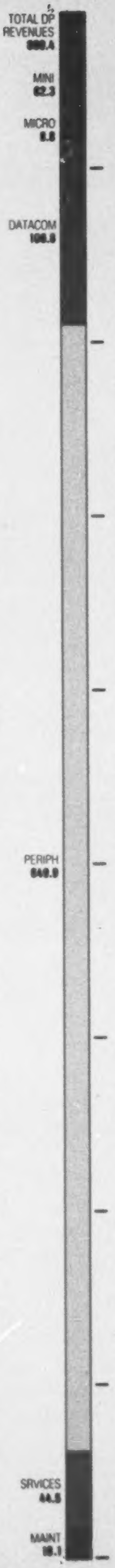
A bigger disappointment came when the MSX pc standard fizzled last year, leaving MELCO and other Japanese manufacturers looking for other ways to get their production lines humming. News was mostly good on the micro front, however: sales to Sperry continued to hold steady and total micro revenues were up about 85%.

Sperry's pc and point-of-sale (POS) terminal orders helped Mitsubishi Electric compensate for the decline in disk drive exports. The global market for disk drives slowed down in 1985. Stepped-up competition from Singapore, Taiwan, and Korea didn't help Mitsubishi either, but all was not bleak. At the end of last year, the International Trade Commission upheld a decision rejecting a floppy disk drive patent infringement suit filed by Tandon of Chatsworth, Calif. (Sony and Teac were also ruled not to have pirated Tandon's technology in this decision.)

MELCO also made the most of its minicomputer muscle last year. Big in factory automation applications, the company currently has a 7% share of the Japanese mini market. Mitsubishi has also zeroed in on factory automation for its digital and optical communications wares. The company is hoping it can be a more active player on the communications scene. Taking a step in that direction last year, it announced it would be selling Rolm's digital PBXs in Japan. It also signed a three-year, $3 million contract to market Aregon International's videotex software in Japan. British company Aregon will tailor its IV-5 videotex software to the Japanese language.

In 1985 Mitsubishi Electric profited from its participation in the Japanese government's fifth generation computer project, officially known as the Institute for New Generation Computer Technology (ICOT). MELCO landed a contract for producing a commercial version of ICOT's sequential inference machine. It also improved its programming expertise last year under another government project, Sigma, which is working on software development tools based on a Japanese language version of Unix.

Revenue figures are in millions of dollars. Each increment represents $100 million.



34

OKI ELECTRIC INDUSTRY CO. LTD.

1-7-12 Toranomon
Tokyo 105, Japan
(81-3) 580-8950

Things were not okay at Oki Electric last year. After an encouraging sales surge the previous year, DATAMATION estimates that, at $1.68 billion (¥400 billion), Oki had zero revenue growth in calendar 1985, with profits plummeting 50%. Probably the only reason Oki turned a profit is because it sold off Kinseki Ltd., a subsidiary that makes crystal oscillators.

Because of dependence on commodity production, Oki has a particularly painful time when there is a prolonged downturn in markets for dp equipment and semiconductors. While other firms have successfully moved upmarket into more software-intensive products, Oki has continued to rely on highly automated factories and economies of scale to churn out dp peripherals with low margins. The lull in semiconductor markets helped increase Oki's dp dependence. Revenues from dp—$890 million (¥211 billion)—accounted for an estimated 53% of sales. As the year progressed, the rising yen took an additional toll on Oki, since North America is its largest overseas market.

At a time when investing in offshore production has increased in importance, Oki is strapped for cash and unable to make the move. Other Japanese competitors like NEC have 20% of production offshore compared with less than 3% for Oki. The cash pinch cut into R&D spending, and Oki's R&D budget was flat in calendar 1985.

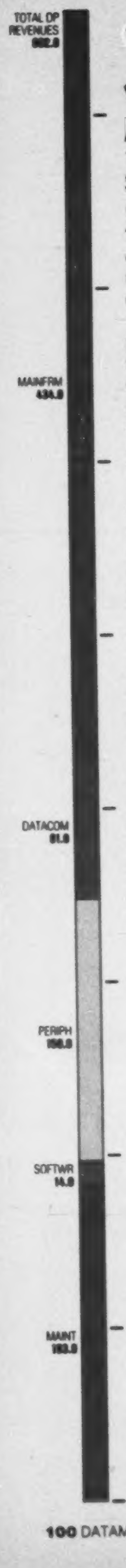
Printer sales deteriorated as the microcomputer market leveled off in the U.S., while floppy disk drive sales fizzled and margins disappeared. Even Oki's substantial investment in factory automation was unable prop up profits.

Much of Oki's peripheral production is done by programmable robots developed and manufactured in-house. Oki has designed its IF 800 line of microcomputers especially for use in multiple configurations for hierarchical control of assembly lines. For internal use as well as outside sales, Oki has developed its own robot software language that makes it easier to produce software in modules for different parts of the system.

Oki's founder, Kitaro Oki, was the first person to manufacture telephone sets in Japan. Dependence on data communications equipment as the mainstay of its product line has continued. Oki is one of the favored group of suppliers to Nippon Telegraph and Telephone (NTT), and an Oki D70 digital switching system is used by NTT in several pilot projects for ISDN applications and marketing research. Sales have increased in Japan for small- and medium-scale digital PBXs.

In overseas markets, Oki's early success at selling facsimile machines to mainland China diminished last year. An agreement with the Chinese government to produce fax machines proved less profitable than had been hoped. The cellular phone market in America, supplied in part by an Oki manufacturing facility in Atlanta, was also a disappointment.

Revenue figures are in millions of dollars. Each increment represents $100 million.



Revenue figures are in millions of dollars. Each increment represents $100 million.

35

AMDAHL CORP.

1250 E. Arques Ave.
Sunnyvale, CA 94086
(408) 746-8510

The year 1985 has already taken on folklore status as one of the most difficult ever for the computer industry, but Amdahl Corp., the leading American pcm, came through with fairly respectable numbers.

Revenues for the year were $862 million compared with $779.4 million in 1984, but net income slipped to $28.7 million from $36.4 million the previous year. Margin pressure, a tough pricing climate, and the strong U.S. dollar's impact on overseas business, which accounts for about 30% of the company's total sales, were cited by Amdahl as reasons for the erosion in profit.

Nevertheless, Amdahl maintained its 11% share of the large systems market. It shipped more cpus, storage products, and communications products than it did in 1984; and it brought its employment level up to about 7,000, from 6,600 the previous year.

During the year, Amdahl shipped about 200 new 580 processors—somewhat better than 1984's results— representing $434 million in revenues. In addition, Amdahl, which entered the supercomputer market late in 1984, sold four vector processors in 1985 as a result, booking about $12 million in revenue. Two of the machines were shipped during 1985, while the other two were scheduled to be installed during the first quarter of 1986.

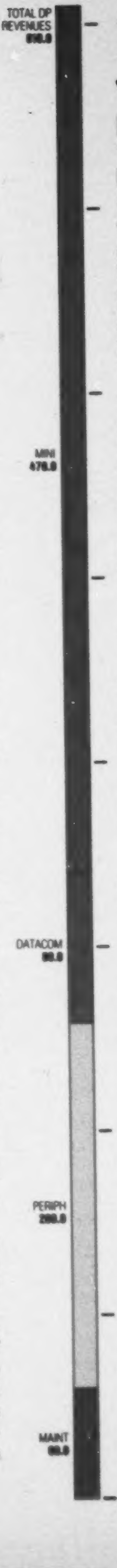
In the storage products area, Amdahl shipped more than 4,000 of its 6280 and 6380 disk drives. These sales accounted for 23% of all hardware-based revenues and 18% of total revenues. The double-capacity AE4 and BE4 6380 drives, announced on Dec. 3, are expected to begin shipping in the fourth quarter of this year.

An oem agreement signed in 1985 under which AT&T was to use the Amdahl 4400 family of X.25 switches in its Net 1000 product and for other applications, did not pan out as expected. In January, AT&T announced that it was shutting down Net 1000 in June of 1986. As a result, Amdahl says, its switch business "is not at expected levels."

The software products business, however, picked up for Amdahl, at least on one front. By the end of 1985, the company's mainframe Unix entry, UTS, had garnered more than 150 licenses in total. In addition, Amdahl, which originally had UTS operating as a guest system under VM, last year brought out a native mode UTS.

On the downside, though, it was reported that the company's Aspen project to develop an operating system to coexist with IBM's MVS had not succeeded as hoped.

Last May, Amdahl hired Joseph Zemke, formerly with IBM and Auto Trol Technology, as chief operating officer, a new post. At that time, due to what the company said reflected Amdahl's increased size and maturation, an office of the president was formed consisting of Zemke and John C. Lewis, president and chief executive. Gene White remains as chairman.



Revenue figures are in millions of dollars. Each increment represents $100 million.

36

HARRIS CORP.

1025 W. NASA Blvd.
Melbourne, FL 32919
(305) 727-9100

This year, the positive notes of Harris's government systems and communications sectors were obscured by negative vibes from the semiconductor and information systems sectors. Net income was hit hard, plunging 33% to $60.7 million from $90.7 million. Revenues came off much better: they rose 5.4%, from $2.19 billion to $2.30 billion.

Perhaps the crowning blow came in January when Harris, considered an attractive stock throughout its times of trouble, suffered a cut in Moody's Investors Service rating of its long-term debt from single A-2 to single A-3. Moody's said a weak market, particularly in semiconductors, and stiffer competition would restrict Harris's ability to generate higher earnings over the intermediate term. Harris naturally told the service where to go, saying the slowdown in certain key markets had ended and it was ready to roll.

The company had plenty of new products to help it along. The apex was reached in June, when the computer systems division introduced its 7MIPS HCX-7 series of 32-bit superminis and the 5MIPS Harris 1200 supermini. Harris claims the Unix-based HCX-7 systems are the highest-performance Unix computer systems available and the first supermini to offer price/performance at less than $40,000 per MIPS. It was part of Harris's grand design to "gain significantly higher market share in superminicomputers," as vice president and general manager James Oyler said.

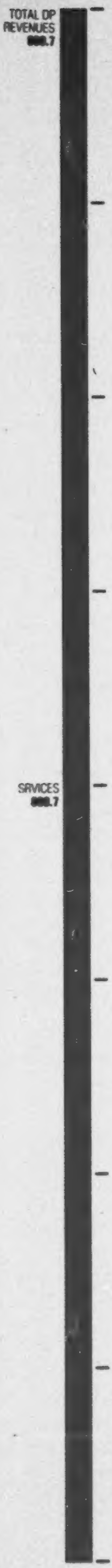
More than 100 new semiconductor products hit the streets during the year, including a large-scale CMOS standard-cell library based on the 8086 microprocessor family of peripherals and a gallium arsenide cell-array family.

Harris was eyeing the office automation and dp markets as well. The company introduced the Harris 9300 work group system, the Lanier Concept III series of office automation systems, and the Harris 20-20 PBX/integrated network switch. A further indication of its commitment came when Harris acquired the domestic direct sales, service, and support operations of Exxon Office Systems Co.

The firm merged its biggest success, the Lanier Business Products sector, with the information systems sector. The two are expected to strengthen considerably Harris's presence in the worldwide information management systems market.

Harris announced in December that AT&T had chosen it for a joint partnership to develop a Ku-Band satellite business communications service. The deal could bring Harris at least $150 million in equipment sales. And in January Harris and 3M Co. announced a joint venture for the worldwide marketing, sales, and service of copiers and facsimile machines.

"As a result of lower product costs, reduced expenses, and new product introductions, we expect to show an improvement in earnings," said chairman Joseph Boyd.



37

COMPUTER SCIENCES CORP.

2100 East Grand Ave.
El Segundo, CA 90245
(213) 615-0311

Things have been looking up at Computer Sciences Corp. and the prognosis is for more good news. In 1985, the computer services firm managed to bag a couple of those $100 million-plus contracts, boosting its revenues to $800.7 million from $709.6 million.

In August, the company announced the largest contract in its history, a $282 million award from the U.S. Customs Service for a secure Consolidated Data Network (CDN) to combine law enforcement and telecom functions and to serve 7,500 sites worldwide via 30,000 connections to data terminals.

In September came a $175.6 million award from the Environmental Protection Agency for support of ongoing operations and to assist in a multiyear modernization program to integrate mainframes, minicomputers, and micros with nationwide telecommunications links.

The period from April to October 1985 saw CSC booking a whopping $802 million in orders, compared with $215 million for the same '84 period, and $386 million, $225 million, and $180 million in the three preceding years. The company is considered a top contender in a number of large pending awards.

Net income for calendar 1985 was $22.3 million compared with 1984's $27.6 million, a figure that had included a nonrecurring gain of $8.7 million resulting from the sale of a subsidiary and some phased-down operations. (For its 1985 fiscal year, ended March 28, 1986, the company earned $27.7 million compared to $27.6 million for fiscal 1984.)

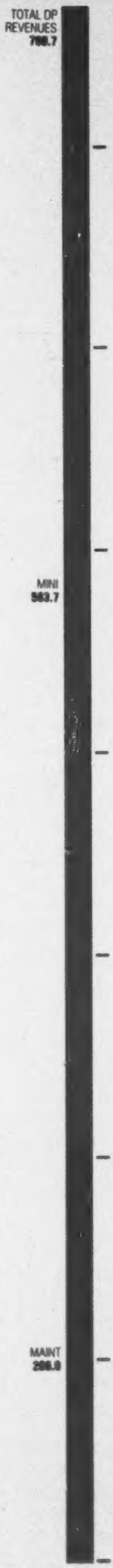
The company's Information Network Services Group, which lost money in 1984, was reorganized and profitable in 1985. Also reorganized was the corporate marketing organization, which managed to improve the company's contract win rate with a little help from its number one competitor, Electronic Data Systems. EDS is becoming more and more involved with a market captive to its new parent, General Motors.

CSC's international revenues were down in '85, due primarily to the winding down of a big contract with Saudi Arabia. The company is still a subcontractor—to the tune of $50 million—to Boeing Aerospace Co. on another Saudi contract and, in June of '85, won a $7.6 million, five-year contract from the U.K. Department of Inland Revenue.

Government at all levels continues to be CSC's biggest market, but an agreement with AT&T announced early this year could boost its commercial business. The agreement calls for CSC to provide a variety of support functions, including some market research, software design, and turnkey software development, in support of AT&T's office automation efforts.

Another portent of increased commercial business was the acquisition early this year of Comtec Inc., Framington Hills, Mass., an information systems supplier to health maintenance organizations. This operation is now part of the company's Industry Services Group.

Revenue figures are in millions of dollars. Each increment represents $100 million.



38

PRIME COMPUTER INC.

Prime Park
Natick, MA 01760
(617) 655-8000

Prime weathered last year's demand slump better than any other mini maker by focusing on carefully selected, high-growth markets and by rapidly expanding its sales force. Prime may not have the dazzling product breadth of a DEC—or even a Data General—but it used what it had to maximum effect in 1985, boosting total sales by 20% to $769.7 million.

As larger rivals froze their hiring or fired people, Prime was in the unusual position of suffering a shortage of sales personnel. The company believes it could have done better still. How? Prime says it can supply world markets with a price/performance-competitive product family with an average age of seven months. "Now all we need are more people to sell it," says president Joe M. Henson, whose new goal is to reach $2 billion a year in sales by 1990.

While larger competitors have been building up their office automation efforts, Prime elected to target the CAD/CAM market. Rather than the volatile and competitive electrical CAD sector, the company focused on mechanical (and architectural) CAD, a market in which there are fewer startups and low-end workstations. The strategy paid off: Prime's CAD/CAM business grew at 33% and contributed 18% of total revenues during 1985.

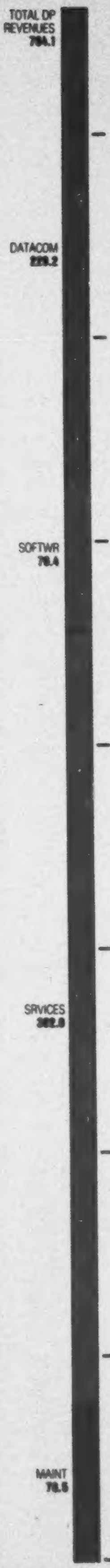
The earnings of more vertically integrated companies were hurt by the IBM PC phenomenon, but with its minimal commitment to the low end, Prime skirted this problem, and profits on recurring operations actually grew 10% to $57.8 million. (Note that last year's $59.7 million net profit figure was artificially boosted by a nonrecurring gain.)

Prime's overseas business, especially in Europe, was exceptionally strong. Foreign sales were up about 15% and constituted 45% of Prime's overall revenue. In 1984, the company took the risky step of using Europe as the first location for what has since become an explosive buildup in its worldwide sales force. This proved to be an auspicious move, as the surge in European demand has more than offset the sluggish domestic demand picture. Europe now accounts for 31% of Prime's total revenues.

The company's strategy of minimizing risk at the low end was apparent in its 1985 product announcements. Two successful medium-sized members of Prime's 50 series, the 2550 and 9650, were superseded by more powerful TTL computers after only 18 months on the market. Yet Prime has still to replace its four-year-old, low-end 2250, despite declining sales. The 2550 was replaced by the 2655 office system, which Prime claims offers 50% more power for the same cost. The new 9655 supermini, 10% more powerful than the 9650 for the same price, was also announced in the fall. Prime's other major product announcement in 1985 was its line-topping 4MIPS ECL supermini, the 9955.

During the year, Prime backed its contention that its stock is undervalued by buying back $6 millions' worth. The company ended the year virtually debt free and with nearly $68 million in the bank.

Revenue figures are in millions of dollars. Each increment represents $100 million.



39

NIPPON TELEGRAPH AND TELEPHONE CORP.

1-6 Uchisaiwai-cho 1-Chome
Chiyoda-ku, Tokyo 100, Japan
(81-3) 509-5035

Following the deregulation path paved by AT&T and British Telecom, Nippon Telegraph & Telephone (NTT) nominally cast off its PTT status in 1985. Although now officially a public corporation, the Japanese government still controls NTT's equity, up to two thirds of which will be sold off over the next 10 years. Japan's Telecommunications Enterprise Law, which went into effect on April 1, 1985, requires the Japanese government to hold at least one third of NTT's stock. That same law, attempting to inject competition into Japan's datacom market, also ended NTT's monopoly over common carrier services.

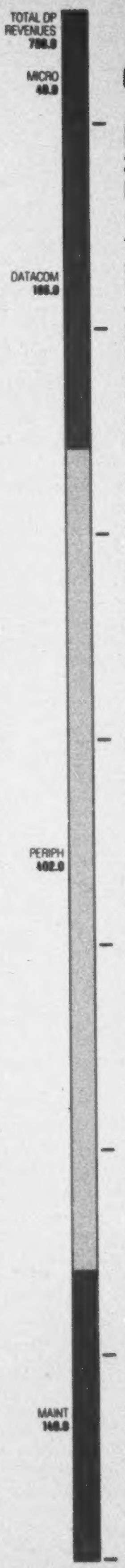
Those common carrier revenues are not included in NTT's 1985 dp total, which DATAMATION estimates to be $764.1 million (¥181.9 billion). Roughly 4% of NTT's earnings came from data communications and computer services. NTT plows a lot of its money back into R&D. In fiscal 1985, 3% of its operating revenue went to 3,800 researchers at its four Electrical Communication Laboratories. A fifth laboratory devoted to software production technologies was established in 1985. A major R&D focus has been on developing technology for the much ballyhooed Information Network System (INS), a nationwide multiservice digital network scheduled to be operational in the next few years.

On-line networks operated by NTT form the backbone of datacom services used in Japanese finance, commerce, manufacturing, construction, and government. Services such as NTT's Denden Multi-Access Online System (DEMOS) and Denden Real Time Sales Management System (DRES) have almost 5,000 corporate and government subscribers. NTT, in collaboration with Fujitsu, NEC, and Hitachi, has developed its Denden Information Processing System (DIPS) series of mainframe computers that are used in-house for supporting datacom services.

While the Japanese telecom market is in principle now open to all comers, NTT remains a formidable competitor. Privatization did not mean NTT had to divest any of its operations, so newcomers face a well-entrenched rival that consolidated its position by forming more than 20 joint ventures and spin-offs in 1985. The most significant tie-up came when NTT and IBM Japan joined forces to form Nippon Information and Communication Corp. The new firm will connect NTT's Data Communications Network Architecture with IBM's SNA through OSI protocols.

The major NTT equipment suppliers—Fujitsu, NEC, Hitachi, and Oki Electric—have asked the Japan Fair Trade Commission to carefully monitor NTT-IBM activities. NTT does not have manufacturing facilities, and the lion's share of its lucrative procurement contracts has gone to local producers. That relationship is unlikely to change, although NTT has attempted to give foreign firms a slice of its procurement pie. Of greater concern to many is the fear that an unrestrained NTT-IBM combine could crowd out competition in the Japanese datacom market.

Revenue figures are in millions of dollars. Each increment represents $100 million.



40

ITT CORP.

320 Park Ave.
New York, NY 10022
(212) 752-6000

This multinational conglomerate entered 1985 as the new part owner, through a 24% stake in STC PLC of Britain, of International Computers PLC. Connection with an established mainframe company, however, has not helped ITT much with its data processing ambitions. Still, DATAMATION estimates ITT's total dp revenues to have been $756 million in 1985, up 18% from the $640 million it took in the year before. Total revenues for the diversified company were $20.01 billion, up 11% from $18.02 billion in 1984.

Consolidating many of its data processing efforts, ITT last year formed a new unit, ITT Business Systems. The organization combines four formerly independent operations: ITT Courier, which makes IBM 3270-type computer terminals; Qume Corp., a producer of peripherals for oem markets; ITT Information Systems, supplier of the Xtra line of IBM PC-compatible computers; and ITT Business & Consumer Communications, a maker of central office telephone switches.

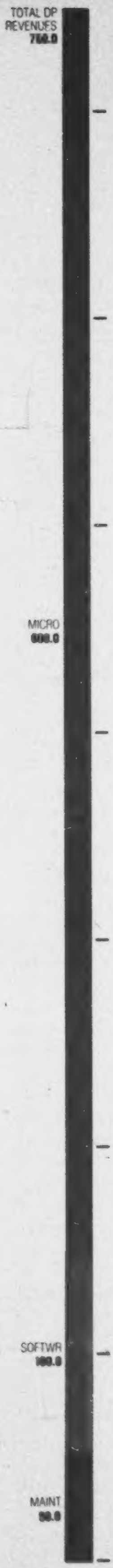
In Europe, ITT introduced a departmental office automation system based on a product of the Courier division; sales of the ITT Xtra pc were extended to the Asia-Pacific region as enhancements were made to keep up with competition; and Qume introduced its first nonimpact printer.

The switch unit has been the focus of much concern from ITT management and its shareholders. ITT has spent an estimated $1 billion, over 10 years, developing a computer-based switch known as System 12, hoping it could win both the European and U.S. telephone markets. Even though $145 million was spent trying to adapt the switch to U.S. needs, software problems were severe. Ivan Cermak, ITT vice president and president of the U.S. System 12 divison, resigned, returning to his job at AT&T Bell Laboratories. In early 1986—just after first U.S. deliveries were delayed by a year—System 12 was withdrawn completely from the U.S. market and 1,600 workers were reported laid off. ITT took a $105 million write-off on the venture.

This botched product introduction has raised questions about how well chairman Rand V. Araskog and Edmund M. Carpenter, president and chief operating officer, can live up to promises they made while fighting off a takeover attempt by Minneapolis investor Irwin Jacobs last year. Jacobs claimed he saw untapped potential in ITT, while the company's managers insisted they were pursuing a long-term strategy with higher potential payoffs. During 1985, ITT sold off 12 industrial technology companies to a New York investment firm; sold its publishing operations to MacMillan Inc.; and sold 48% of its U.K. company Abbey Life Group Ltd. in a public offering.

Retrenching further in the U.S. telecommunications market, ITT early this year arranged to sell its Dialcom electronic mail service to British Telecom. ITT had bought Dialcom in 1982 but, despite its sales of $18.9 million in 1985, had not earned a profit with the company.

Revenue figures are in millions of dollars. Each increment represents $100 million.



41

COMMODORE INTERNATIONAL LTD.

1200 Wilson Dr.
West Chester, PA 19380
(215) 431-9100

In a year that saw price cuts and increased competition in the depressed office and home pc markets, only the savviest vendors could hold their own. Don't count Commodore among the savvy: bankruptcy rumors dogged the company last year as it registered three consecutive quarterly losses and struggled to make a splash with a new product, the Amiga. Swollen inventories of earlier machines and an uncertain future for the Amiga don't paint an optimistic picture for 1986.

Commodore appears to have made a strategic mistake when it named Marshall Smith ceo and director. He replaced Jack Tramiel, now chairman of Atari Corp. Smith, who had no experience in the computer industry and no marketing background, was slow to respond to the changing home computer market, allowing inventories to accumulate; he failed to cut prices when competitors were slashing theirs. Commodore is now hoping that new president and ceo Thomas J. Rattigan will lift the company out of the doldrums. Rattigan, who assumed daily operating control, is a former PepsiCo Inc. executive who joined Commodore in the spring of 1985 as president of its North American unit.

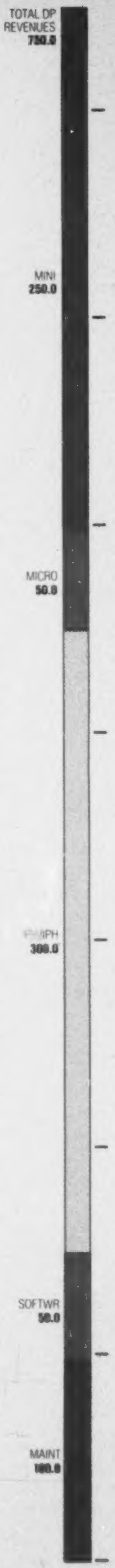
The Amiga—which the company spent $40 million to promote—is widely praised for its technology, but has fallen short of sales targets. Last May, Commodore projected sales of 200,000 units by March 1986, but it appears that 75,000 will be a more accurate count. Observers say the machine, priced between $1,500 and $2,000, is too expensive for the home market and doesn't have enough software for the business market. Commodore's Rattigan has conceded that third-party software development for the Amiga has fallen short of company expectations.

Meanwhile, the company has inventories of the Commodore 64 and peripherals that must be liquidated at a loss. (Analysts believe that Commodore was left with about $450 million in inventory after Christmas 1984. In late fall of 1985, analysts reported the company was sitting on 1 million unsold Commodore 64 computers.) Inventories at the end of last September were $306 million, the company claimed.

Commodore reported a loss of $39.2 million for the fiscal first quarter ended last Sept. 30, following losses of $20.8 million in the quarter ended March and $124 million for the June quarter, including a $63 million inventory write-down. As a result of the June loss, Commodore's auditors qualified their opinion of the company's fiscal 1985 report, and the company's banks said Commodore wasn't complying with certain financial tests of its loans. All of Commodore's debt was converted to short-term status while the company negotiates with its banks over new lending terms.

The company showed a net loss of $237.2 million for 1985, compared with earnings of $100.3 million in 1984. Revenues were off 33.9% from 1984's $1.2 billion to $798.6 million in 1985.

Revenue figures are in millions of dollars. Each increment represents $100 million.



41*

TEXAS INSTRUMENTS INC.

P.O. Box 225474
Dallas, TX 75265
(214) 995-2011

Texas Instruments' 1985 performance was about what you'd expect from a company whose fortunes depend heavily on semiconductors and computers. Its $61 million loss in semiconductor components and $48 million loss in digital products were major factors in the company's $115 million pretax loss.

TI net sales billed in 1985 dropped to $4.9 billion from last year's record $5.7 billion. Dp revenues were no more satisfying, off 12.7% from 1984's $860 million to $750 million. Semiconductor sales plunged by $700 million to about $2 billion, while digital products dropped by $147 million to $1 billion.

Added to these problems, declining oil prices continued to erode the company's geophysical exploration market, which accounted for $407 million in sales last year compared with a peak of $649 million in 1981. To cope in this environment, the company slashed its worldwide work force by more than 8,600, primarily in semiconductors and data systems. That brought TI's total employment down to 77,872.

In the spring, Texas Instruments agreed to accept the resignation of J. Fred Bucy, president and chief executive officer, who took early retirement at 56. Spokesmen say Bucy retired to pursue other interests, such as education and his family's agricultural affairs. But the abruptness of the move led observers to conclude the company's poor performance had much to do with the resignation.

Bucy's successor, Jerry R. Junkins, 47, is an electrical engineer who has been with the company 26 years. TI watchers say Junkins will help to strengthen TI's market strategies, long a weakness at the engineering-oriented company.

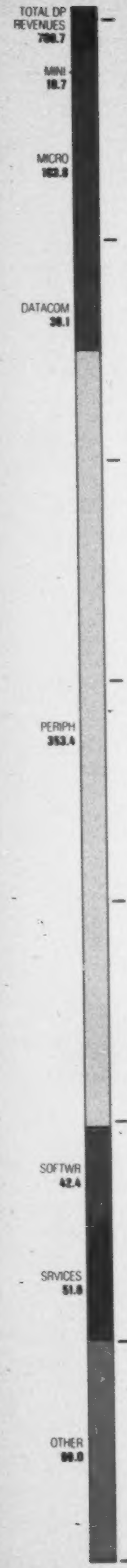
Despite all its problems, the company raised its research and development spending in 1985 to $402 million, from $367 million in 1984. (That number didn't include an additional $367 million in customer funded R&D carried out at TI). One of the results was the industry's first million-bit computer memory chip and the first working gallium arsenide semiconductor chip containing all of the functions needed in a phased array radar system.

The company continues to develop new products incorporating artificial intelligence, aiming these products at military, industrial, geophysical, and commercial applications. In the spring of 1985, it began shipping its Explorer computer, TI's first symbolic processing system. In the winter of 1986, it announced agreements with two manufacturers of computer workstations to incorporate its AI processor into their products. It will link Apollo networked workstations with the Explorer and will also allow Explorer users to access files on Unix-based workstations made by Sun Microsystems.

This spring, it introduced a new business computer system, the model 1500, the first of a series of 32-bit computers that will use the Unix system, called TI System V, and be priced from $70,000 to $408,000. Shipments will start in late summer.

*Commodore and Texas Instruments were tied for 41st place.

Revenue figures are in millions of dollars. Each increment represents $100 million.



43

C. ITOH & CO. LTD.

5-1 Kita-Aoyama 2-Chome
Minato-ku, Tokyo 107, Japan
(81-3) 497-7293

A gigantic Japanese trading conglomerate, C. Itoh acts as a sales intermediary to firms selling their high-technology wares in foreign markets. DATAMATION estimates that dp products accounted for less than 1.2% of C. Itoh's 1985 revenue of $61.4 billion (¥14.6 trillion). Because of the scale of C. Itoh's operations, that puny percentage means about $706.7 million (¥168.3 billion) worth of hardware and software changed hands.

C. Itoh's global reach extends to 143 cities in 86 countries. Hundreds of Japanese dp producers use C. Itoh's worldwide marketing network to get their goods distributed in foreign markets. Fujitsu Kasei's 3½-inch floppy disks, for example, are marketed worldwide under the C. Itoh brand name.

In the U.S., three subsidiaries peddle Japanese-made products. C. Itoh Electronics sells printers, monitors, floppy disk drives, handheld data-entry devices, IBM-compatible terminals, electrostatic plotters, and portable facsimile telecopiers. CIE Systems offers microcomputers and software, while CIE Terminals markets line printers and graphics displays that are compatible with Tektronics and DEC monitors.

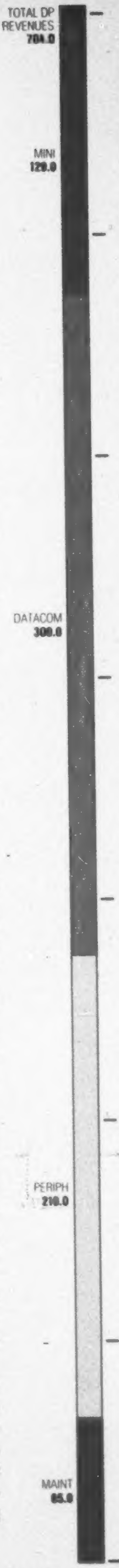
In 1985, Toshiba's tie-up with Sun Micro Systems to market the U.S. manufacturer's workstations caused C. Itoh to lose sole Japanese distribution rights for Sun Micro Systems products.

In Japan, C. Itoh subsidiaries sell dp goods and services. C. Itoh Data Systems (CIDS) provides customized computer systems, CAD/CAM, factory automation, software, and dp services. A contract with IntelliGenetics Corp. in the U.S. gives CIDS marketing rights to that company's software packages for biotechnology research. C. Itoh teamed up last year with Nippon Telegraph & Telephone Corp. to form a joint videotex company, Nippon Telematique Inc. It will market private videotex systems based on NTT's Character and Pattern Telephone Access Information Network (CAPTAIN) system.

Another C. Itoh offshoot, Century Research Center Corp. (CRC), provides remote computer and and timesharing services on a Cray-1 supercomputer. CRC, which has developed a number of supercomputer software packages, also offers various scientific and engineering computing services. NEC and Cray, for instance, have several contracts with CRC for supercomputer software development.

An established relationship with Hughes Communications led to a new joint venture in 1985. Following the partial deregulation of the Japanese telecom market in April, Hughes, Mitsui & Co., and C. Itoh joined to form Japan Communications Satellite Co. The new company plans to orbit two Hughes comsats to provide high-speed data communications to Japanese users. The Japanese Ministry of Posts and Telecommunications already has approved the service and C. Itoh is developing and marketing software that will allow corporations to extend existing networks with Hughes satellites.

Revenue figures are in millions of dollars. Each increment represents $100 million.



44

MOTOROLA INC.

Motorola Center
1303 E. Algonquin Rd.
Schaumburg, IL 60196
(312) 397-5000

A good year in the communications business saved Motorola Inc. from an otherwise disastrous 1985. Overall, revenues were down 2% to $5.5 billion and earnings dropped 81% to $72 million from last year's $387 million. Until last year, profits from communications had trailed semiconductor earnings by at least half. But in 1985, the communications sector reported a profit of 10.5% on sales of $2.3 billion, while semiconductor sales of $1.7 billion were down 23% and the firm lost $38 million on the business.

Superficially, Motorola's data processing operations looked better: revenues rose 13.9% to $704 million. But the bottom line told a grimmer truth: the business produced a $17 million loss. The company says the loss was due chiefly to a reorganization of Four-Phase Systems Inc., which will henceforth be part of the General Systems Group. Other dp operations are Codex, the network and modem maker; Universal Data Systems, which also sells modems; and ISG International, the global arm of the company's Information Systems Group.

The international group introduced intelligent processors—the models 650 and 660—that enable smaller network users with from 100 to 500 terminals to construct X.25 packet switched data networks. The processors also enable users to apply switching capabilities to multiplexors that typically function only point to point.

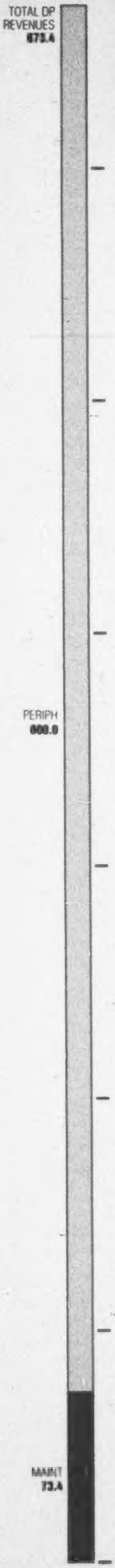
Codex introduced a 19Kbps modem, called the 2680, that provides network management and control in an integrated fashion as well as diagnostics. It also brought out the 6700 series of distributed communications processors. Universal Data introduced 16 modems ranging in speeds from 1,200bps to 14,400bps.

What was then Four-Phase Systems came up with a series of software offerings to enhance its hardware. One was the Business Assistant, office application programs for the company's microcomputers, said to make Unix operating systems easier to use. Its other product, TransText, is a communications software program that provides a connection between departmental systems and the IBM distributed office support system (DISOSS). It also introduced an addition to its Series 2000 family of microcomputers, the 290, which supports up to 16 networks and uses the Motorola 68010 microprocessor chip.

Teamed with other units of Motorola, Four-Phase supplied the State of California Department of Social Services with an office automation network consisting of Series 2000 microcomputers and Business Assistant software as well as Codex local area networks and Universal Data Systems modems.

At year-end, Robert W. Galvin, Motorola's chairman and ceo, said, "We have reduced our costs dramatically and selling prices have stabilized." More important to the future of the company's profits, he added, "orders turned upward during the last quarter of the year."

Revenue figures are in millions of dollars. Each increment represents $100 million.



Revenue figures are in millions of dollars. Each increment represents $100 million.

45

STORAGE TECHNOLOGY CORP.

2270 S. 88th St.
Louisville, CO 80028
(303) 673-5151

A reorganized Storage Technology Corp. prepared to emerge from Chapter 11 bankruptcy proceedings last year, wearier and perhaps wiser after a series of disk subsystem fiascos that included $100 million squandered on an optical disk drive project.

The company ended 1985 in tatterdemalion shape: it lost $57.4 million on sales of $673.4 million. Nevertheless, these numbers represent an improvement over 1984, when the company went into the red to the tune of $505.4 million on sales of $808.6 million. There was a ray of hope visible in STC's fourth-quarter 1985 numbers: on sales of $168.6 million, income of $2.2 million, $1.1 million of it from tax credits. (By contrast, in the fourth quarter of 1984, STC had lost $406.1 million on sales of $151.9 million.) These figures represented the firm's first profit in two and a half years.

The company's chairman and ceo took more comfort from the $2.2 million than did many industry observers. "Our performance in the fourth quarter gives us reason to believe we have been successful in stabilizing the business," Ryal R. Poppa noted. "Each quarter in 1985 showed marked improvement, and we expect this stabilizing process to continue.

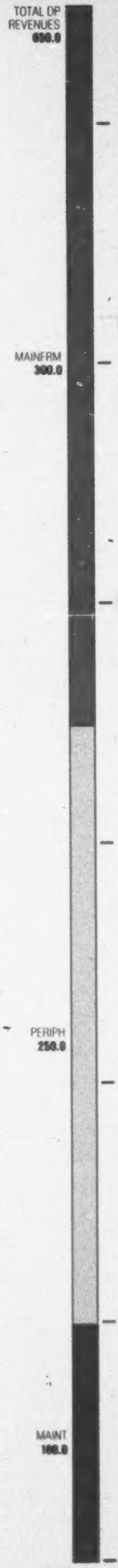
"We are engaged in a constructive dialog with representatives of our creditors and expect that our improving order rate and financial performance will lead to a mutually agreed upon reorganization plan this year," said Poppa, noting that any plan could substantially dilute the interest of current shareholders.

The crux of STC's problems may be found in the company's 10-K form, filed with the Securities and Exchange Commission. It lists, among other things, "delays in shipments of new products, reliability problems with the 8650 disk drive, heavy investment in research and development, and increased price and performance competition. . . ."

Under Poppa's stewardship, STC has acquired a cash balance of $170 million, plus the ability to fund more than $60 million for product development. The firm also cut prices on several products in an attempt to stay competitive with IBM. These cuts include 10% off the announced price of its dual-capacity 8380E disk drive, plus a 5% reduction in upgrading costs for its single-capacity 8380 drive. Both these products were scheduled to ship during the second quarter of 1986.

Cost-cutting was also in evidence. Poppa tightened the corporate belt—selling off a $6 million jet plane—reduced inventories, and made managers submit weekly reports on finances. He got rid of about 4,000 employees and took the company out of the chip building business.

Richard R. Douglas, senior vp, marketing and services, said near year's end that preliminary orders of the new 8380 E and 8380 upgrade storage devices are "pretty much what we expected." He declined to give specific numbers, but said that despite the price cuts, his firm intended to make a profit.



Revenue figures are in millions of dollars. Each increment represents $100 million.

46

NATIONAL SEMICONDUCTOR CORP.

2900 Semiconductor Dr.
Santa Clara, CA 95052
(408) 721-5000

Like a man clinging to a life preserver in a storm, National Semiconductor Corp. last year held fast to its profitable National Advanced Systems PCM subsidiary while its bread-and-butter semiconductor business floundered, a victim of the worst chip market downturn in memory. By the end of 1985, National was ready to elevate NAS and its other systems operations—boards and the Datachecker point-of-sale business—to organizational status equal to that of the Semiconductor Group. NAS president David N. Martin became executive vice president of the new Information Systems Group.

Information Systems Group sales for the calendar year grew about 18% to an estimated $650 million, with NAS mainframe and peripherals sales accounting for about $500 million of that. National's systems business contributed about 40% of the company's overall sales for the year of $1.61 billion, down about 11.6% from 1984 revenue levels, mostly because of the semiconductor downturn.

While NAS was profitable, it was not enough to offset the disastrous plunge in the semiconductor market. Overall, National lost $93.3 million for the calendar year compared with 1984 positive earnings of $84.3 million. Despite the mounting losses, National increased its R&D spending for the year by 29% to $204.6 million.

NAS, which resells PCM and storage hardware manufactured by Hitachi Ltd., benefited by being the first PCMer to ship a double-density disk system compatible with IBM's 3380 Model E. NAS's 9080 mainframe line remained price/performance competitive with available models of IBM's Sierra series, and observers say NAS may leapfrog IBM's 3090-200 system performance with its new 9000XL, expected to ship late this summer. In fact, analysts have predicted NAS's sales could rise between 50% and 70% in 1986, primarily on the strength of the 28MIPS 9000XL. EDS-GM, Shell, and British Petroleum are among its best customers. If the predictions hold, NAS's share of the IBM-compatible mainframe market could grow from an estimated 5% now to 7% or 8%.

With NAS business booming and a gradual firming of the semiconductor market, analysts expect National to return to profitability by this August. Over the long term, however, the company has proved to have holes in its chip business. Specifically, its 32000 32-bit microprocessor family has picked up only about 8% of the total micro market. That share could be threatened later in the year when Intel is expected to begin shipping its 80386 32-bit microprocessor in large volumes. If National can't improve its microprocessor market share, its semiconductor business will be forced to rely on its commodity memory products, which should remain under severe price pressure. If National's semiconductor business can't break out of its slump, National in 1986 may have to rely more than ever on data processing markets for growth and profitability.

47

RICOH CO. LTD.

15-5 Minami-Aoyama 1-Chome
Minato-ku, Tokyo 107, Japan
(81-3) 479-3015

Ricoh has been reaching out for partners to help it move more aggressively into office automation markets. That strategy paid off in 1985 when dp revenues skyrocketed to $634.7 million (¥151.1 billion), which represents an increase of 35%, according to DATAMATION estimates.

Total corporate sales rose 10.3% and net income grew by 8%. The appreciation of the yen has necessitated increases in overseas pricing, hurting Ricoh's competitiveness in some product areas. Still, exports accounted for more than 35% of the company's total sales.

Much of Ricoh's growth came from sales of the facsimile machines, the mainstay of Ricoh's information processing division. Pitney Bowes, Kalle-Infotec, Savin, and Hermes all rely on Ricoh for facsimile equipment. Declining fax prices, however, have hastened Ricoh's move into more lucrative dp markets.

Ricoh hopes that laser printers will be one of those lucrative markets. Last year the Japanese firm inked an oem contract to supply DEC with about 1,000 laser printers a month. While the laser line looks promising, Ricoh's conventional printer business has turned sour and gone into the red because of competitive pressure.

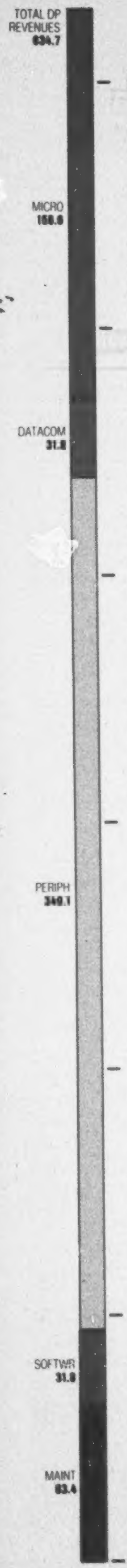
Image processing is a key technology for automating the Japanese office. Ricoh remains a contender in the emerging market for office systems that integrate fax, Japanese word processing, and copier functions.

A three-year oem contract, signed in 1984 with AT&T-International for fax machines, strengthened Ricoh's ties to the American telecom and dp company. Ricoh now sells AT&T's 3B minicomputer series in Japan.

In September 1985, AT&T-I established a joint venture to manufacture and sell AT&T's key telephones in Japan. Ricoh has also expressed an interest in manufacturing a line of Unix-based business microcomputers for AT&T, but the telecom giant's conflicting tie-up with Toshiba will probably push Ricoh out of the picture.

AT&T's reluctance to provide Ricoh with the telecom technology needed for its integrated systems strategy hasn't hurt the Japanese firm's efforts to move into office automation. Ricoh has signed up other manufacturers to round out its product line. Hitachi produces a series of 16-bit personal computers for the company.

At the beginning of this year Ricoh reorganized its dp product divisions into one group. The step, which helped the company's marketing effort, also gave Ricoh some synergy in new product development. One example is the new Ricom I series of business computers that combine voice recognition and image processing functions. Nevertheless, Ricoh faces tough competition from Japanese competitors Matsushita and Canon, both of which also are zeroing in on the integrated office systems market.



Revenue figures are in millions of dollars. Each increment represents $100 million.

48

TANDEM COMPUTERS INC.

19333 Vallco Parkway
Cupertino, CA 95014
(408) 725-6000

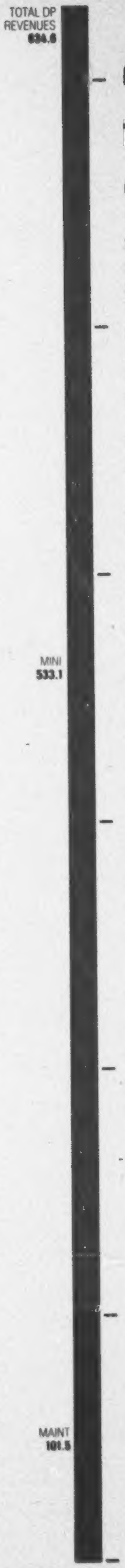
Since Tandem Computer is in the fault tolerant business, maybe it was equipped to find 1985 more tolerable than some of its Silicon Valley neighbors did. While revenues were up 12% to $634.6 million, earnings dropped 31.8% to $31.9 million. It was a far cry from recent years in which both earnings and profits were growing like weeds, years in which 25% improvements were seen as disappointing.

The on-line transaction processing firm's fourth quarter looked best of all, said president James Treybig, and sales for that period were up only 14% over 1984: $173.8 million as opposed to $153.1 million. "During that quarter, business in the U.S. improved for the first time this year," he noted.

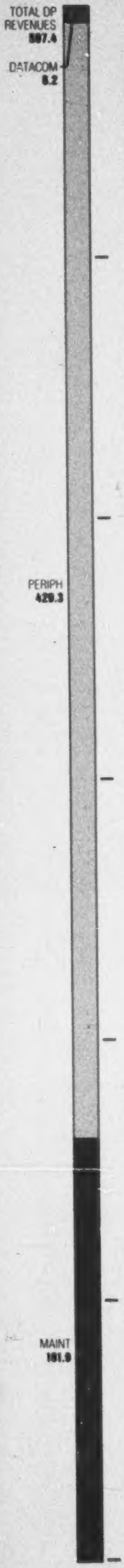
Last year, its tenth year of dominating the fault tolerant market, Tandem introduced its NonStop EXT machine, the smallest of its fault tolerant products, one also able to function as a standalone node outside the computer room environment. Selling for $120,000, the device offers the performance of Tandem's two-processor NonStop II system, but combines all systems hardware and disk storage in a single cabinet to which other modules can be added.

Yet another new product was Fox Link, which permits the interconnection of up to 14 NonStop II and NonStop TXP systems located as much as one kilometer apart. Since each system can contain as many as 16 processors, as many as 224 processors can be linked in a local cluster. Fox Link claims data transmission speeds almost 300 times faster than those achieved with conventional dual 56Kbps communications lines. Other new products included an enhanced version of its Guardian message-based operating system for NonStop systems, and a series of information management technology products built on Tandem's Transfer software. These products include PS Mail for electronic mailing, filing, and distribution of documents; PS Text Edit and PS Text Format software for text editing and formatting; Faxlink for moving pages and pictures electronically; and PC Link software for integration of IBM PCs and compatible micros into distributed networking applications. Last year, Tandem spent $71.6 million on R&D to keep the new products coming, 26% more than in 1984.

IBM inserted one fly into Tandem's ointment during the year. Stung when Tandem landed a lucrative $10 million contract with retailer J.C. Penney, IBM decided it had to have a fault tolerant offering of its own, so it cut an oem deal with Stratus Computer Inc. of Marlboro, Mass. Here, Stratus will sell an unspecified number of its OLTP machines to IBM; Big Blue will then tailor them for applications to include banking, credit card verification, and airlines reservations, three markets Tandem has heretofore had sewn up. In an apparent response, Tandem this spring announced the Nonstop VLX system, specifically targeted at its banking, telecommunications, and airline customers, and described as 65% faster than existing Tandem machines.



Revenue figures are in millions of dollars. Each increment represents $100 million.



Revenue figures are in millions of dollars. Each increment represents $100 million.

49

TELEX CORP.

6422 E. 41st St.
Tulsa, OK 74135
(918) 627-2333

Telex Corp. performed unusually well in a year when most of IBM's plug-compatible competitors fared quite badly. Telex's 1985 sales of $683.1 million advanced 30.4% from $523.8 million, and net income rose by 41% to $67 million. Computer products account for 86% of sales and a second company, Telex Communications Inc., accounts for the rest.

The company has become the largest independent supplier of IBM-compatible terminals, terminal products, and controllers for large mainframes. It holds 14% of the market for IBM 3270 terminals, a market share that is growing at 2% a year. Telex estimates this market to be worth $1.25 billion.

Telex holds a 29% share of the airline reservation terminals business, following its acquisition of a division of Raytheon Corp.

Last December, Telex paid about $28 million to acquire United Technologies Communications Co. and subsequently changed the name to Telexecom, making it a division of Telex Computer Products Inc. (TCP). With the acquisition of Telexecom's telecommunications business, Telex now holds a 2% share of the private branch exchange (PBX) market, currently dominated by AT&T and Northern Telecom Inc., each of which holds 23%.

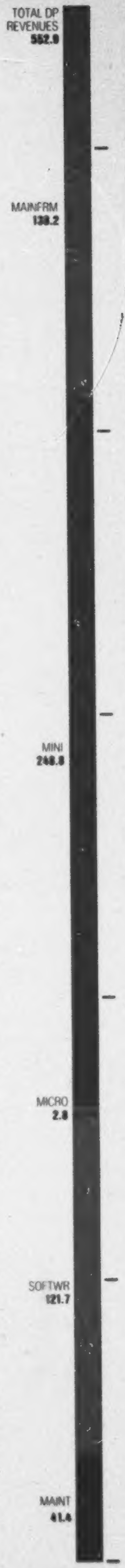
In its 1986 fiscal year, which started last April 1, the company expects its revenues to top $850 million, even though it is beginning the year with a backlog $10 million lower than the year before. The company explains that it trimmed its terminal product lines after the acquisition of Raytheon, reducing order volumes slightly.

About half of Telex Computer Products' volume comes from outright sales, 25% from leases, and the rest from maintenance and other services. Corporate R&D expenditures increased 65% in its 1985 fiscal year and now run at about $2.4 million a month.

Last year Telex introduced its first internally developed color printer and new terminal controllers. It announced enhancements to its so-called Intelligent System series, including an interface board that enables travel agents to handle reservations and ticketing while using MS/DOS software for their local business needs.

This summer, as a result of its two recent acquisitions, the company will unveil a new line of airline reservation terminals bearing the Telex logo. It will also introduce an IBM 3270-compatible voice-data terminal using technology it obtained through its Telexecom acquisition. A new line of terminals that are compatible with IBM's smaller systems, the System/36 and 38, will be introduced as well.

Telex's market for oem tape drives is expected to remain depressed this year, but Telexecom, which was losing money when acquired, is expected to break even this summer and to be doing well by the fall of 1986. And Telex says it is beginning to regain overseas sales it surrendered when it sold some European subsidiaries eight years ago; last year it opened a Telex Computer Products plant in Scotland.



Revenue figures are in millions of dollars. Each increment represents $100 million.

50

NIPPON UNIVAC KAISHA LTD.

2-17-51, Akasaka, Minato-ku
Tokyo 107, Japan
(81-3) 585-4111

A venerable name lives on in Japan under the banner of Nippon Univac, the product of a Sperry alliance with Mitsui & Co., Mitsubishi Electric, and Oki Electric.

The tie-up goes back to 1958, when the company was established as a joint venture with trading conglomerate Mitsui to market Sperry dp products in Japan. Reflecting their importance as primary equipment suppliers, both Oki and Mitsubishi Electric each have taken a 2.5% equity stake in Nippon Univac. Sperry and Mitsui have equal 34.2% shares of Nippon Univac's stock. The balance is owned in small pieces by Japanese financial interests.

The year 1985 wasn't a bad one for Nippon Univac. DATAMATION estimates 1985 earnings were up 6.1% to $10.4 million (¥2.5 billion) on sales of $552.9 million (¥131.6 billion), representing revenue growth of more than 11%. As is typical in Japan, double-digit sales growth came with a razor-thin profit margin of only 1.6%, down from 1.7% the previous year.

Imports from Sperry accounted for only about 17% of Nippon Univac's total sales, mainly for the Series 11 mainframes and peripherals manufactured in the U.S. Those imports are likely to decline in the future. Univac mainframe sales in Japan are sagging—down about 7% in 1985—because of Sperry's slow response to Sierra. Oem agreements with Oki Electric, the Seiko Group, Toshiba, Tokyo Sanyo, Mitsubishi Electric, and Northern Telcom account for about 70% of Nippon Univac's dp sales.

Oki Univac, a joint venture with Oki Electric, manufactures part of the Nippon Univac product line in Japan. Computers produced by Oki Univac account for about 13% of Nippon Univac's sales.

Although some of the DASD for its mainframes come from Sperry, Hitachi also supplies some of Nippon Univac's disk drives. The relationship with Hitachi seems likely to strengthen in the future. Throughout 1985, Sperry and Hitachi worked out a technology exchange agreement covering VLSI, peripherals, software, and cpu design for mainframes. Tokyo's financial circles have since buzzed with rumors that Hitachi was negotiating to take over at least a portion of Sperry's share of Nippon Univac as part of the deal. Tapping Nippon Univac's sales and services network as well as its pool of 2,000 soft-ware engineers would be of great strategic value to Hitachi.

With 500 specialized software engineers working at subsidiaries and joint ventures, Nippon Univac has one of the largest pools of employees in Japan with experience building dp systems from a wide variety of oem equipment. The firm's strength in software is beginning to look increasingly attractive to cash-rich Japanese firms needing the software expertise required to compete in the fastest-growing dp markets. Sperry's joint venture in Japan may be an important bargaining chip for putting together future alliances with Japanese manufacturers.

51

INTERGRAPH CORP.

1 Madison Industrial Park
Huntsville, AL 35807-9985
(205) 772-2000

Intergraph Corp., the CAD/CAM specialist that's been a favorite among investors in high-technology companies, reported a modest 7.7% increase in profits in 1985, to $67.8 million. Total sales were up a more impressive 30% to $526.4 million. Compared to 1984, when revenues had leapt 60.2%, the good news paled. Management blamed some of the slowdown on increased R&D funding and high marketing costs. (In 1985, the company exhibited its products at nearly 30 different trade shows; it will trim down to 11 shows in 1986.) Still, in the turbulent world of CAD/CAM, where 1984's number one company, Computervision, was last year's number three, Intergraph came out okay. Shareholders were cheered in May by a 2-for-1 split in the company's stock.

Last year, Intergraph began delivering its 32-bit desktop workstation, the Interpro 32, aimed at the computer aided engineering market. Shipped late—unforeseen software problems—the product is compatible with IBM PCs and the Ethernet local area network and emulates DEC, Tektronix, and IBM terminals.

The company's fastest growing market is in manufacturing. It was one of the vendors that participated in a manufacturing automation protocol (MAP) exhibit at the Autofact factory automation conference in Detroit. The General Motors-sponsored protocol aims at standardizing interfaces in factory automation networks, and is being advocated by Boeing and other large users.

While building its own file processors, communications processors, and graphics processors, and its own workstations, the company buys its board sets from DEC. This frees Intergraph to concentrate on software development. Its DEC products range from the MicroVAX II to the VAX 8600-based system at the very high end of the market.

More than two thirds of its volume, 69%, is from U.S. markets and another 18%, from Europe. Intergraph recently beefed up its Japan sales operation—to 26 persons—and set up a software development center in France to exploit what it sees as a growing overseas market.

52

COMPAQ COMPUTER CORP.

20555 FM 149
Houston, TX 77070
(713) 370-0670

Compaq Computer's 1985 performance was a refreshing contrast to that of many other computer companies in a bleak year of price-cutting and deferred buying.

The company's 1985 revenues of $503.9 million rose 53% over the 1984 figure of $329 million, and its earnings of $26.6 million represent an increase of 106.2% over 1984. This was based on shipments of more than 200,000 personal computers in 34 nations, including the U.S.

The performance led president and ceo Rod Canion to declare euphorically early this year that the four-year-old company's formative years are over: it's become a major company.

This is not to say the company has no problems in the markets it has staked out: faced with competition from more than 100 other makers of pcs together with a growing flow of low-priced products from the Far East, the company has been forced to make some price cuts of from $500 to $800 on earlier models and said it soon may have to turn out lower-priced systems to compete with the imports. As PC clones become commodity goods, Compaq could stand to lose sales. In addition, IBM's recent price cuts and the introduction of the 13-pound IBM PC Convertible may prove troublesome.

Otherwise, all has been going well for Compaq. The key, many observers say, is its kid-gloves treatment of its dealers: the company offers higher gross margins to dealers; it is compatible with IBM and thus protects its dealers' investments in software, peripherals, and support; and it doesn't have a direct sales force. Last year it became the first computer manufacturer to sell to the federal government through dealers, when it signed an agreement with the General Services Administration. Compaq dealers sold to government agencies without going though extensive federal bidding processes. Compaq has similar deals with four states.

It keeps its own house in order, too. Last year it launched an inventory management program that reduced its inventory balance by 12% to $76 million from $86 million at year-end 1984. In effect this added $42 million to Compaq's cash balance.

Compaq's research and development budget, which runs at around 3.2% of sales, reached $15.9 million in 1985, $5 million more than the year before.

The company, whose main products have been portable and desktop computers that are compatible with IBM's offerings, announced higher-end versions of these last year—the portable 286 and desktop 286 that offer 30% faster processing speeds than the IBM AT. The new Compaqs incorporate the Intel 80286 microprocessor, a much faster successor to the Intel 8088. Early this year, Compaq introduced three smaller models of its Portable family, called the Portable II. The packaging was redesigned to make each product 30% smaller and 17% lighter, and they were priced, according to memory capacity, at from $3,499 to $4,799. The Portable II family weighs 23.6 pounds.

53

COMPAGNIE GENERALE D' ELECTRICITE

56 rue La Boetie
75008 Paris, France
(33-1) 456-31414

Compagnie Générale d' Electricité (CGE), the nationalized electrical engineering group, has widespread interests in computer services, telecommunications, and electronics, concentrated in Groupe Alcatel, which hauled in an estimated $480 million (FF4.3 billion). Software services and systems engineering accounted for $312 million, whereas about $145 million came from digital PBXs and terminals. At the lower end, just over $20 million stemmed from sales of micros.

While parent company CGE has been trying very hard to seal a deal with AT&T on central office switches, Alcatel itself has been busy working out the organizational details of its merger with another big French nationalized electronics group, Thomson. CGE took over Thomson Telecommunications on Jan. 1, 1984, but the fusion didn't become final until last July, 18 months ahead of schedule. The Thomson name has essentially been eliminated by Alcatel to prevent confusion. The one major exception is Thomson-CFS Telephone, which markets private PBXs and telephone equipment in competition with Alcatel's affiliate, Telic. Thomson-CSF Telephone's digital PBX revenues amounted to about $67 million in 1985, compared to Telic Alcatel's $56 million.

Alcatel has two small subsidiaries involved in dp hardware, Alcatel Thomson Micro-Informatique Professionnelle (ATMIP) and SMH Alcatel. Inherited from Thomson, ATMIP sells the Micromega micros that are produced by Eagle and Fortune in the U.S. In fact, Alcatel has a 25% stake in Fortune, which makes its 32-bit Unix machine. One quarter of ATMIP's $20 million in sales were derived from exports. The other hardware company, SMH Alcatel, which produces word processing systems and desktop terminals, had revenues of $22.5 million last year.

In the software and services sector, Alcatel controls two major companies and two smaller ones. The biggest, Générale de Service Informatique (GSI), had revenues of $138 million in 1985, up from $128 million the year before. GSI sells general management and vertical application packages. One of its most important products, the Tolas financial management system, was developed by GSI's United States subsidiary, Transcom.

The other big services company under Alcatel's wing is SESA (Société d' Etudes des Systèmes d' Automation), which specializes in network engineering. Alcatel, which owns 97% of GSI, has a smaller, 51% stake in SESA. Last year the company pulled in revenues of $95.8 million, about

30% coming from exports. SESA is the architect of France's packet switched data network Transpac; its biggest customer is the French Defense Ministry. In addition to its bread-and-butter network operation, SESA also has a growing systems and software engineering business. The other two services firms in the Alcatel group are Answare, which contributed revenues of roughly $40 million, and TITN, which chipped in $38 million.

54

COMDISCO INC.

6400 Shafer Court
Rosemont, IL 60018
(312) 698-3000

Comdisco has successfully carved a niche out of Big Blue's hide, leasing new and used computers. Last year, the big news in Rosemont was the attack of the IRS agents: the Feds said Comdisco owed in excess of $200 million to settle audit claims for 1980, 1981, and 1982, based on conflicting interpretations of tax shelter regulations. Kenneth N. Pontikes, Comdisco's chairman and president, managed to speed the case's progress through tax court, with happy results for the company: in early 1986 the case was settled, Comdisco paying a mere $6.1 million.

The tax dispute was viewed as a big negative on Wall Street, where Comdisco's stock dropped $8 in one day. But MIS managers continued leasing from the company.

In fact, during 1985 Comdisco's dp business was up 20.7% to $467.9 million. Earnings were amazing, bounding up 93.6% to $57.5 million, even before an extraordinary payment of $30 million, which made the increase a whopping 195%.

Many industry observers had thought 1985 would be a tough year for Comdisco as IBM moved customers up to the Sierra. Indeed, Comdisco experienced a slowdown when IBM announced its new Sierra machine, but once the Sierra was delivered, Comdisco made profitable new deals selling and leasing the used 3080s that Sierra was replacing. Pontikes claims the used machines are bargains compared to Sierra measured in MIPS for the money.

Efforts to broaden the company's revenue base have been far flung, including a Disaster Recovery service and risk arbitrage. So far, none of these efforts have yet approached the financial rewards of computer leasing.

55

BRITISH TELECOM PLC

81 Newgate St.
London EC1A 7AJ, England
(44-1) 356-5000

Brokers cheered on the floor of the London stock exchange the day British Telecom (BT) went public in 1984. They called the $6 billion flotation, the largest share issue ever made, "The Sale of the Century." In a single day 51% of the government-owned telecom monopoly was transferred into 1.7 million private hands.

Britain is the first, and so far only, European country to have taken the momentous step of selling off its telecommunications authority.

Some critics say that sale was at bargain basement prices. But BT chairman Sir George Jefferson had no such doubts. "I am pleased to be able to record notable achievements both in the successful transition of British Telecom into the private sector and in a satisfactory year's trading as the new regulatory environment has been taking place," Jefferson wrote in BT's first annual report last year.

Jefferson's pleasure was perhaps premature, for, in truth, British Telecom's first year as a publicly held, private company was less than thrilling. Revenues rose a tame 6%, to $10.5 billion (£8.1 billion), and earnings slipped 12%, to $1.2 billion (£958 million).

A newcomer to the DATAMATION 100, British Telecom derives the bulk of its business from the communications side—Britain's sprawling telephone network, to be exact. Still, the company's computer-related business produced 1985 revenues of $455.1 million (£355 million), making British Telecom the second biggest U.K. dp company.

In addition to its telecom and dp activities, the newly deregulated company also has interests in cellular radio, undersea cables, and satellite communications. BT has also branched out into overseas markets. Chairman Jefferson has already made two moves abroad, both in Canada, paying $250 million for a controlling interest—51%—in PBX company Mitel and $20 million for telecom distributor CTG. The Mitel deal took almost a year to complete. The delay was due to the intervention of the British Monopolies and Mergers Commission, which feared that the BT-Mitel tie-up might stifle competition in the U.K.'s PBX market.

British Telecom, like its smaller U.K. counterpart, Mercury Communications, operates under a government license that establishes the basic business ground rules. A watchdog committee, called the Office of Telecommunications (Oftel), fields complaints from BT's customers, suppliers, and competitors.

One of the biggest beefs about British Telecom came when the company signed a $150 million contract with Thorn Ericsson for AXE-10 digital PBXs. The move brought howls from locals Plessey and GEC, both suppliers of BT's homegrown System X public exchange. Oftel, which warned British Telecom to limit its overseas purchases, has also been investigating complaints about a 12% increase in private line charges and gripes about unfair competition from suppliers of end-user equipment.

56

VOLKSWAGEN AG

Postfach 3180
Wolfsburg, West Germany
(49-53) 6190

West German car manufacturer Volkswagen, 40% of which is owned by the West German government and the state of Lower Saxony, had total dp revenues of $452.9 million, up 16% from 1984, produced by its subsidiaries, German-based Triumph Adler, U.S.-based Pertec Computer Corp., and Pertec Peripherals.

Triumph Adler's dp revenues were up an encouraging 17% when measured in local currency, and after years in the red, the company was inching back toward profitability: in 1985, the shortfall was only $34 million, compared with a dismal $122 million loss the previous year. The situation was similar in the U.S.: both Pertec subsidiaries suffered from the slack U.S. dp market and new managers were moved in to head the firms. For 1985, Pertec Computer Corp. contributed $42.5 million to Volkswagen's dp take, while Pertec Peripherals chipped in $43.7 million. Neither company made any profit.

These grim figures inspired Volkswagen to take a different approach: in 1986 it sold Triumph Adler to Olivetti for a 5% stake in the Italian company and an undisclosed amount of money.

Pertec Peripherals' rough ride was partly the result of a shake-up of its entire product line. The company announced last year that it was phasing out almost all its tape products, including the T1000, T6000, T7000, T8000, and T9000 drives, which were based on old technologies. Also on the scrap heap went its D3000 series of disk drives.

Last year Pertec added the FS2911 quad density tapes and new Winchester drives caled the DX368 and DX548.

Pertec Computer's new president Ed Hale, meanwhile, spent the year rebuilding the company. During 1985 he closed down one facility and fired over 100 people, about a third of the work force.

Triumph Adler was also reshaping its business. Although the company is proud that one in seven of the electronic typewriters bought around the world is a TA machine, the longer term corporate strategy is full integration of office automation products, based on the company's main dp line, the M32 multi-user system running under the company's own Xenix derivative, Tanix. This is sold alongside TA's Alphatronic office products, its P60 and P50 IBM-compatible personal computers, and the Ergonet network for pcs, typewriters, and M32s.

These products brought in 25% of Triumph Adler's overall revenues, and the company has set a target of getting 50% of its business from data processing by the end of the decade.

57

COMPUTERVISION CORP.

100 Crosby Dr.
Bedford, MA 01730
(617) 275-1800

The year 1985 was the one in which Computervision began to resemble the last dinosaur in an emerging world of warm-blooded mammals. The old ways of computer aided design that the company pioneered had given way to the new: suddenly the CAD landscape was populated by workstations, pcs, and industry-standard operating systems. Not only had new generations of CAD moved to general purpose computers, but new generations of CAD applications software had shifted to microcomputers at prices that were a fraction of earlier systems.

Unfortunately for the Computervision bottom line, its renowned library of CAD/CAM/CAE software has yet to make this shift to other popular computers. Failure to adapt cost the company dearly. Mounting quarterly losses almost drove the company into extinction in a single year and forced a 26.6% reduction in its work force. The bottom line revealed losses of $80.8 million, compared with a $41.4 million net profit a year earlier.

In a market that is growing at 25% a year, Computervision's sales dived 21% to $441.1 million, and the company fell from its number one spot in the market to a wobbly number three (behind IBM and Intergraph).

The U.S. picture was even more dismal than these numbers suggest. The domestic market provided only 42% of the company's total revenues, compared with 55% a year earlier.

Computervision was in the odd position of getting the lion's share of its dwindling sales from Europe (48%, a huge jump from 35% the year before).

The losses represented a resounding no from customers to the new products that Computervision began to ship late in 1984—the high-end CDS 5000, based on an IBM 4300, and a low-end workstation, the CDS 3000, built by Sun Microsystems. But while the company attempted to broaden its proprietary product line with these oem offerings, it failed to outfit them with effective new software or to offer networking links to existing products.

The critical missing ingredient to a successful rebound of the company is the conversion of its acclaimed CADDS 4 software library from a machine language version of FORTRAN to the more portable Unix operating system, so that it can operate on the CDS 3000 workstation—and eventually on popular pcs. This complete porting process isn't expected to be completed until late this year, at best, and in the interim the company has undergone a management shake-up aimed at getting ballooning costs under control.

58

MARTIN MARIETTA CORP.

6303 Ivy Lane
Greenbelt, MD 20770
(301) 982-6500

First the good news. This space- and defense-oriented company had a banner 1985, with sales increasing 12% to a record $4.4 billion from the previous record of $3.9 billion in 1984. Net income rose a tidy 41.7% to $249.4 million, there was a 3-for-2 stock split, and the quarterly dividend was raised 12%.

Now the bad news. Martin Marietta Data Systems (MMDS), the nova of 1984, burned much less brightly. True, both MMDS and Martin Marietta Information & Communications Systems had combined revenue growth of nearly 50% and they are the fastest growing of any Martin Marietta elements. And it's true that sales looked great on paper, rising 18.7% to $430 million from $361.5 million in 1984. But something must have been lost in translation. By the time that number reached the bottom line, it had become a loss of $10.3 million. That's a rather precipitous decline from the $18.9 million MMDS earned in 1984.

"We had two major problems," says Patrick J. Zilvitis, who in October became president of MMDS after 17 years as IBM's manager of large account personal computer sales and marketing organization. "After going back and forth on an old fixed-price contract with the [U.S.] Department of Labor, we went back with them and redid it.

"Our second problem was the packaged software business," Zilvitis says. "That may be the reason there were management changes at the top. We consolidated four different groups into one. They had a very ambitious revenue target and they missed it by a lot."

By about 20% to 25%, according to Zilvitis. Much of that shortfall occurred in second-half sales of RAMIS II, MMDS' flagship product. Development spending was another downer. Slotted for 15% of expenses, it finished at a hefty 22%.

By the end of 1985, though, MMDS seemed on its way to righting the wrongs. Zilvitis will have several new products to help him back to profitability. Foremost among them is RAMIS II's Release 85.3, shipped in December. That on-time, as-promised enhancement should alleviate user dissatisfaction with RAMIS II, one of the leading fourth generation languages despite its well-chronicled problems.

The company won new contracts on a number of command, control, communications, and intelligence programs; and also introduced Unison Workstation Manager, a DOS shell program that provides a uniform interface to all pc routines, and Consensus, an integrated on-line applications development system that gives users a selection of programming languages and environments.

59

DATAPOINT CORP.

9725 Datapoint Dr.
San Antonio, TX 78284
(512) 699-4427

The 1985 computer recession was but another problem on a long list suffered by Datapoint Corp., a onetime high-flyer that has continued to disappoint both investors and customers. At year's end, the company reported a net loss of $62.1 million, compared with a profit of $24.2 million the year before. Revenues also suffered, dropping 27.3% to $404.2 million.

Datapoint's problems began in late 1982 when it was forced to write down $15 million against nonexistent orders reported by an overeager sales staff. That brought its stock down from a high of $67 in 1981 to less than $11 (it was priced at around $6 this spring). Last year it underwent the turmoil of a takeover bid by Asher Edelman, a then relatively new member of the growing breed of corporate takeover artists. Edelman took control in March 1985, owning about 11% of Datapoint's nearly 17 million shares and creating doubts in customers' minds as to whether the company would continue to exist as a full-service computer vendor.

Their fears may have been realized in the events that followed. The company began shedding itself of recent acquisitions, including its Inforex subsidiary and its huge service business, Intelogic Trace Inc.; Edelman and Datapoint's management turned down a bid of $177 million by TRW for the service company and instead spun it off to shareholders; and Edelman and other insiders last September announced a plan to take Datapoint private through a $100 million leveraged buyout, which is about $6 a share, considerably less than the $23 Edelman had offered to take over the company earlier in 1985. This May, the leveraged buyout scheme was dropped.

Meanwhile, Datapoint had been pared from a thriving organization with some 10,000 employees housed in 41 buildings in San Antonio in 1981 to about 4,000 people in 15 buildings. And financial observers were suggesting that, if the company were taken private, Edelman might start hacking away at the company R&D spending and might even liquidate Datapoint. While denying this, Edelman admitted that "anything is possible."

Customers were given some hope when Datapoint introduced three new products last year. Its Starship I processor, with 4Mb of main memory, offered users a bridge from DOS operating systems to the newer RMS (resource management system) operating system; the MINX (Multimedia Information Network Exchange) system, a product that will integrate video and office communications with personal computers and local area networks in advanced offices; and a joint project with Japan's Fujitsu Business Communications to build an integrated voice and data system.

The products are aimed at Datapoint's existing customer base of some 6,500 local area networks. The company said that later in 1986 it will be seeking new customers.

60

CONVERGENT TECHNOLOGIES INC.

2700 North First St.
P.O. Box 6685
San Jose, CA 95150-6685
(408) 434-2848

Saddled with bad luck and charges of mismanagement, Convergent Technologies Inc. did the impossible last year even as it took on a new chief operating officer. Having written off $13.8 million in losses early in 1984, it then buckled down to emulate Lazarus. By the end of the year, many in Silicon Valley were saying the firm had a fighting chance. Corporate revenues for 1985 were $395.2 million, up 9.2% over the $361.7 million posted for 1984. From enduring a net income loss of $13.8 million in 1984, Convergent was $11.5 million in the black at year-end 1985.

Many were saying that Paul Ely, formerly an executive vp of Hewlett-Packard, had saved the mini maker. When a rival was named ceo at HP, Ely moved to Convergent, replacing founder Allen Michels, a technological whiz somewhat short on business and management skills. "I think Convergent got a bargain [in Ely]," said the amiable Michels when he left in November.

Ely made a number of fast moves. He scrapped the company's Workslate microcomputer offering and moved quickly to mend fences with Burroughs Corp. For months it had been no secret that Convergent's NGEN, which it had been selling to Burroughs, had more bugs than a June night in Biloxi. Burroughs was rumored to be considering pulling out of its agreement with Convergent, worth an estimated $45 million annually. Late in the year Ely announced that Convergent would begin shipping the machine, which Burroughs sells as the B28, early in 1986.

Industry analysts were speculating that 25% of Convergent's revenues were coming from its deal with AT&T Information Systems (AT&T-IS). Before Ely's arrival, Convergent had contracted to build Unix 7300 PCs for the unregulated arm of the phone company. Other products Convergent launched for AT&T-IS last year included the enhanced Unix PC Model 3B1 and the Personal Terminal 510A. Earlier, Convergent announced Mighty Frame, a 32-user machine based on the Motorola 68020 processor. The machine's operating system is CTIX, Convergent's version of Unix. An NGEN enhancement was also rolled out. Called Series 286 NGEN, the 80286-based machine was claimed to run twice as fast as the previous 80186 device.

In November, Convergent announced plans to acquire 40% of Baron Data Systems of San Leandro for $14.6 million. Baron makes computer systems for the legal and medical markets. Also announced was a proposed merger with LAN maker 3Com Corp. of Mountain View, Calif. If it had been consummated, 3Com shareholders would have owned 27% of the new company, to have been called Convergent. The stock transaction was valued at $126.5 million, but failed at the last minute after 3Com's bankers said the deal would represent a loss as structured.

61

RACAL ELECTRONICS PLC

Western Rd., Bracknell
Berkshire, England
(44-344) 483-244

Modem maker Racal simply did not connect in 1985. The company's dp revenues were a wrong number, down 17.7% from 1984 to $380.8 million. The overall corporation's net income also suffered, falling 11% to $138.5 million.

The recession that hit American datacom last year was a real blow. The company's two U.S. subsidiaries, Racal-Milgo and Racal-Vadic, which used to account for 40% of total revenues, were chipping in only 27% when half-yearly results were announced.

Preparing for hard times, Racal trimmed its U.S. work force by 1,200 and postponed its plans to expand a Miami manufacturing plant that makes Racal-Milgo's three new Omnimux 82 multiplexor models. In October, Racal-Milgo unveiled a series of diagnostic data service units, a fiber optic multiplexor, and encryption devices that use the DES algorithm. A month later, Racal-Vadic, which concentrates on the lower end of the market, came out with 9,600bps and 1,200bps modems.

Racal-Milgo has found itself under increasing pressure from IBM. Big Blue's token ring local area network, introduced last year, is a direct competitor to Racal's Planet ring network. In a bid to keep ahead of IBM, Racal announced IBM-compatible, file server software for Planet and a controller that can hook together four of the networks. Racal claims that its interconnected rings can support up to 2,000 users, compared with 260 on the IBM offering.

There will be no new products from Racal's AI joint venture with Norwegian mini maker Norsk Data. Racal-Norsk, which was set up by the two companies in hopes of developing wares for expert systems applications, has been closed down. Other communications market opportunities, however, opened up last year. The company's Australian subsidiary won a $135 million contract in September to supply the Australian Department of Defense with a digital trunk communication system. Racal also managed to pull off two other large communications deals in 1985—one for $46 million with the U.S. Postal Service and another valued at $15 million with Japan's Nippon Telegraph & Telephone.

The company also took steps to win more communications and electronics contracts in the States and Canada. In August, it formed Racal Corp., which will oversee the operations of all its North American companies. David Elsbury, who is deputy ceo of the parent company, was named president of Racal Corp.

62

CRAY RESEARCH INC.

608 Second Ave. S.
Minneapolis, MN 55402
(612) 3333-5889

The supercomputer giant had another super year in 1985. In response to the strong demand for supercomputer power from industry, government, and universities, Cray shipped 28 units, up from 23 in 1984; 55 processors were installed in 1985, up from 38. Four of the supercomputers went to international sites, and Cray now has an installed base of 115 machines worldwide, representing 79 customers; 79 of the machines are in the U.S. and 36 are installed abroad.

Company revenues were $380.2 million in 1985, up a whopping 66.1% from 1984. After-tax revenues were $75.6 million and net earnings were up 66.5%. R&D expenditures were 13% of revenue, or $49.2 million. Over the last five years the company claims to have spent $160 million on R&D and plans to spend half that, $75 million, in 1986 alone.

The powerful, four-processor Cray-2, developed by a team lead by founder Seymour Cray, was introduced in June 1985, and by year's end was installed at two sites.

In the competitive arena, Cray is "not standing still," asserts chief financial officer John Carlson. New products in the works include the Y-MP, a follow-on product to the X-MP, due for release in 1987 but rumored to be shipping early; the Cray-3, under design by Seymour Cray, which will utilize gallium arsenide technology; and a project under design by Steve Chen, who headed the X-MP design team, for a silicon-based multiprocessor supercomputer.

The company expects 1986 to be another good year. Carlson expects the Gramm Rudman Act to have little impact on 1986 government orders and installations because of the Reagan administration commitment to defense spending. The Strategic Defense Initiative holds "tremendous potential for Cray," he states. One third of 1986 revenues are earmarked for software development, the plan being to standardize the company's product line on the Unicos operating system. A new FORTRAN compiler will be available by midyear. Cray expects supercomputer shipments to jump from 28 to 40 units this year and processor

9-TRACK MAGNETIC TAPE FOR YOUR IBM PC

$3495.

At last you can access large databases of information stored on your mainframe computer. Our "TAPE CONNECTION" system is used by hundreds of companies for label processing, report filing, check processing, sales analysis, and off-line printing. Our system features:

- 3 MB/MIN TRANSFER
- LABELLED TAPES
- 45 MBYTE/REEL
- MULTIVOLUME FILES
- 1600 OR 6250 BPI
- RECORD SELECTION
- 10000 HOUR MTBF
- EBCDIC-ASCII FORMAT
- SMALL SIZE 12"x 20"

A complete system including tape drive, card, cable, and software is priced at **only $3495.**

Since 1982, we have installed thousands of conversion systems at customer locations around the world. Call us today for help in connecting a 9-track tape system to your IBM PC.

CONNECTION
DATA CONVERSION SYSTEMS

Flagstaff Engineering
1120 W. Kaibab • Flagstaff, AZ
86001 • Telephone 602-779-3341

CIRCLE 52 ON READER CARD

shipments to double, from 56 to 112. With sales figures like these, Cray's closest supercomputer competitors, CDC and Japan Inc., have a tough act to follow.

63

DATAPRODUCTS CORP.

6200 Canoga Ave.
Woodland Hills, CA 91365
(818) 887-8000

In 1985, Dataproducts Corp. revenues dropped by nearly $110 million from the previous year as original equipment manufacturers trimmed their inventories to cope with the computer slump. In the six months between the end of its fiscal year on March 30, 1985, to the end of September, the Woodland Hills, Calif., supplier of computer printers lost more than $33 million.

By the end of 1985, it had managed to trim operations enough to eke out a $1 million fourth-quarter profit, but its backlog of orders was only $110 million, compared to $150 million a year ago.

So the company fired its president. Charles A. Dickinson, 61, who had been president five years when he was discharged in April, admitting he hadn't recognized the severity of the downturn in time to take action. Graham Tyson, chairman and a cofounder of Dataproducts, reclaimed the presidency and immediately launched a belt tightening that closed two plants in California and one in Puerto Rico and laid off 2,000 employees. A new chairman and ceo was also named: Jack Davis, formerly a senior vice president at Harris Corp.

The company increased its research and development spending slightly (to $32 million in its fiscal year 1985 from $28 million the year before) and announced new laser printer products, the LZR 2650 and 2655 programmable nonimpact printers, and the LZR-1230, which prints 12 pages a minute and is priced at $3,495. It also brought out new models of its dot matrix and line-band printers.

Dataproducts, formed in 1962, has concentrated on printers for original equipment computer manufacturers, but in recent years has also sold its products through storefront dealers, distributors, and value-added resellers.

64

TEKTRONIX INC.

14150 S.W. Karl Braun Dr.
Beaverton, OR 97077
(503) 627-7111

"If you have read recent financial reports of other electronics companies, you may be prepared for ours," says the 1985 annual report of Tektronix Inc. Known for sprinkling its accounting to stockholders with dashes of wry humor, it adds, "Dour economists hint of a 'possible recession.' That makes us wonder idly what they call the year we just completed."

But Tektronix did better than some of its competitors. Sales were up, but by only a fraction, to $1.43 billion over 1984's $1.42 billion. Profits of $92.7 million, however, were down 25% from the year before. DATAMATION estimates that dp revenues were off 5% for the year, dropping to $366.9 million.

The bad news started in the second half of 1985. In the last two quarters of the year, the company's sales dropped by $151.7 million from the first two quarters of 1985. Despite this poor performance in the second half, there were signs toward year-end of a recovery: the company's continued investments in research and development, product introductions, and acquisitions were apparently paying off, especially in its design automation and information display product categories. R&D spending reached a record $201 million last year, $32 million over the previous year.

Tektronix introduced a new family of scientific and engineering workstations, called the 6000 series, which will enable users to design and simulate complex circuit layouts. Its first model, the 6130 intelligent graphics workstation, is designed for engineering data analysis, software development, and computer aided engineering functions. The more powerful model 6205 adds computer aided design facilities.

Tektronix added capabilities to its artificial intelligence applications development workstation, the model 4404, with the August debut of the 4405 and 4406 models, and it introduced its own version of the AI language Lisp, called Tek Common Lisp.

The usually conservative, engineering-oriented company made a noisy splash at a design automation show in Las Vegas when it showed off design and test products of its most recent acquisition, CAE Systems Inc., Sunnyvale, Calif. "To longtime Tek watchers . . . [it] might have been like seeing Grandpa break-dancing," quipped the annual report's account of the affair.

Tektronix was formed in 1946 to produce the oscilloscope and still is the world's largest producer of the product, which accounts for nearly a third of Tektronix sales. That and other instrument products account for 43% of the company's total sales. Design automation and information display products make up 39% and communications products 18%.

65

BASF

Carl-Boschstr. 38
D-6700 Ludwigshafen, West Germany
(49-621) 601

German chemical giant BASF bubbled with pride at the end of last year when its dp business broke through the billion deutschmark barrier. BASF Data Technology pulled in revenues of $357.1 million (DM1.05 billion) in 1985, a 19.7% increase in local currency.

That billion-mark business, three quarters of which came from Europe, represents three main product lines—peripherals and magnetic media and plug-compatible systems based on Hitachi mainframes. The company reports it currently has an installed base of 23,000 peripherals and 400 mainframes.

To keep its mainframe wares competitive, BASF announced two new mainframe models last year. Hitachi systems that match the IBM 3090/200 and IBM 3090/400 were introduced as the BASF 7/90-2 and the BASF 7/90-4. Deliveries on those machines are scheduled to begin this summer. Fellow German dp company Nixdorf, which decided to upgrade its installed base of 8890s using low-end Hitachi mainframes, signed a deal in '85 with BASF to buy some 600 machines over the next five years.

Back on the product front, BASF added punch to its peripheral wares by unveiling the 6485 disk storage system. Compatible with the IBM 3380-E, the 6485 has a 5GB capacity and an average access time of 17 milliseconds. As the inventor of magnetic tape, BASF has always regarded storage media as a mainstay of its business and last year was no exception. In 1985 BASF became the first company to provide chromium dioxide tape cassettes for the IBM 3840 drives. It also signed a deal with DEC for joint work on disk storage technologies. This year the company's R&D budget has been increased by 20%, much of those funds being used to develop optical storage techniques for future products.

While those new technologies are being studied, BASF Data Technology will also be gearing up to meet its 1988 revenue target of DM1.5 billion. The company hopes to achieve that goal by developing enhancements to its mainframes and by marketing new peripherals along the lines of the 6890 laser printer that debuted at this year's Hannover Fair.

66

MANNESMANN AG

Mannesmann Ufer
4000 Dusseldorf 1, West Germany
(49-211) 8201

The dp business of the Black Forest-based Mannesmann group is not quite out of the woods, despite revenues of $355.7 million (DM1.04 billion) in 1985. (Total corporate revenues were $448.1 million, or DM1.3 billion in local currency.) Last year the company's dp subsidiaries showed only an 8% increase in revenues in local currency, compared with a 21% jump in 1984.

Mannesmann puts most of the blame for its bland performance on sluggish printer sales, which grew a scant 2% in 1985. In 1984 those printer sales had soared an impressive 35%. The printer operation trades as Mannesmann Tally; while this part of the company recorded a 23% revenue growth in Europe during 1985, the poor performance resulted from a contraction of business overseas.

There was healthier growth on the hardware and systems software side, where revenues from Mannesmann Kienzle Data Systems were up 18%. Some of those gains can be attributed to its 9000 series of small systems. Last year the company signed up its 10,000th user of the 9000 and unveiled new entry-level models in the series.

Mannesmann's export trade for its mainstream dp products also picked up in 1985. Sales in the West German home market rose 13%, compared with an overall export increase of 26%. France, Britain, and the Benelux countries are the strongest foreign markets for the company.

Last year the Mannesmann Kienzle subsidiary strengthened its position as a dp supplier to small- and medium-sized firms by setting up new subsidiaries. In an effort to expand its European business, Kienzle created a new company last year to specialize in systems for gas stations and distributors. More vertical market spin-offs are expected this year. The West German firm also formed its own software house in Dusseldorf last year. Mannesmann Kienzle Software, which will develop products for Kienzle's own machines, could be used as a corporate stepping-stone into broader markets.

The expansion strategy also affected Kienzle's third-party maintenance business, which the company believes to be a future gold mine. Since the beginning of 1985, Kienzle has offered maintenance service across Europe, promising spare parts delivery within 24 hours in any major city. The company has some 1,300 engineers on its books and runs the service mainly from the U.K. This expansion requires people: in 1985, the company hired 250 more people to help handle the increased business. Still, Mannesmann kept tight reins on productivity during the hiring, and average revenue per head increased by 9% during the year.

This year the focus is on strengthening Kienzle's export business, which accounted for 59% of 1985 dp revenues. Kienzle has put special emphasis on the U.S. market. This strategy, the company hopes, will help it to beef up sales of all its dp operations, smoothing out its erratic revenue performance over the last few years.

67

ZENITH ELECTRONICS CORP.

1000 Milwaukee Ave.
Glenview, IL 60025
(312) 391-7000

Zenith Electronics Corp., the huge television manufacturer, lost $7.7 million last year when it became involved in a television price war, but its computer operation had a spectacular year. And as the new year got under way, a flood of government orders ensured even better faring in 1986 for its Zenith Data Systems subsidiary.

The corporation attributed its 1985 loss to price competition in consumer electronics from the Far East, notably Korea and Taiwan, which brought its sales down to $1.62 billion from $1.72 billion the year before. Its loss of $7.7 million contrasted with a $63.6 million profit a year earlier. Spurred by the introduction of five new models, Zenith Data Systems sales soared 41.3% last year to reach $352 million, compared with $294 million in 1984.

Last year it introduced three IBM-compatible desktop computers—the Z-200 Advanced PC, which is compatible with IBM's PC AT; the Z-158, a faster version of an earlier model; and the Z-148, an entry level desktop system for both consumer and business use. It also brought out two portable computers, the Z-171 battery-operated system, which has dual 5¼-inch floppy disks, a liquid crystal display, and weighs less than 15 lbs.; and the Z-138, a heavier 24-lb. system.

This spring, Zenith began delivering the first of up to 18,000 Z-171s to the Internal Revenue Service, under a highly visible procurement that pitted Zenith against a field of 12 vendors, including IBM. According to trade press reports, IBM had been favored in the bidding with its then unannounced product, later introduced as the Convertible. The order, valued at $27 million, will be filled over a one-year period and service and support will run through 1995. A much larger order, for 90,000 of Zenith's Z-200 systems, was awarded at the same time by the Air Force. It was valued at between $200 million and $500 million.

Although the company has achieved much of its success through these big-ticket contracts to the military and government, late last year it began to step up its sales to its top 500 business accounts by offering more incentives for local dealer support of its direct sales force.

Although microcomputer prices are falling—and the company expects them to continue to fall—Zenith feels it will be ready, having played a price-cutting game in the television market that makes falling micro prices look tame. In a recent interview, marketing vice president John Frank said, "Other companies look at ways to cut the $30 parts; we look at ways to cut the 40 cent parts." Evidently, its customers like it that way.

68

ARTHUR ANDERSEN & CO.

69 West Washington St.
Chicago, IL 60602
(312) 580-0069

Companies whose primary business is money are recasting their balance sheets and public images. No longer are they banks, insurance companies, and accountants: nowadays, they are "information" companies. Because dp allows and encourages the integration of services, the future will only make it harder to determine what's pure dp and what isn't, particularly when it comes to computer services.

Take Arthur Andersen, the Big Eight accounting firm. When businesses first began using computers in the 1950s, the accountants were placed in charge. Therefore, it is not surprising that Arthur Andersen & Co. derives a considerable amount of revenues from helping clients work with computers.

Arthur Andersen attributes a third of its 1985 revenues, or $477 million, to billing clients for management information consulting. (The company's accounting and audit work produced revenues of $767 million, and $329 million was from tax consulting). The company doesn't report profits, but this year's revenues were $1.57 billion, up 13.4% from 1984, and management information consulting, which went from $391.9 million to $477.3 million, represented a 21.9% increase. The company has offices in 48 nations and in 80 cities in the U.S. The number of its employees has been rising steadily from 21,000 in 1981 to nearly 30,000 this year.

What does Arthur Andersen do for dp clients? It provides help, which, according to some independent consulting organizations, is often tied into its accounting services.

Its earliest visible job was as a consultant to General Electric Co., which built the first payroll system in 1952 on a Univac I computer in Louisville, Ky. Arthur Andersen now has some 7,000 consultants in its computer services operation who plan, design, and install computer-based information systems for clients. In that group are some 250 technical staffers who perform research on new developments ranging from artificial intelligence to office automation.

The company sells a product, called Method/1, that basically manages and designs computer-based information systems installations. Arthur Andersen has also developed two software packages, Manufacturing Planning and Control System and Distribution Control System, as well as integrated manufacturing, distribution, and financial software for IBM's System/38 computers, including FIN-PAC/38, DCS/38, and MAC-PAC/38.

69

XIDEX CORP.

2141 Landings Dr.
Mountain View, CA 94043
(408) 988-3472

Xidex is the number one producer of floppy disks in the U.S. Soon it will be tops in rigid disks as well.

Xidex was founded in 1969; 16 years later, aquisitions made 1985 the company's best year ever: revenues hit $342.1 million. The acquisition that contributed most to this affluence was that of a larger competitor, Dysan Corp. of Santa Clara. Dysan was number 81 in the DATAMATION 100 last year. But despite the big revenues, profits for the combined operation were down 29.6% to $17.8 million.

Prior to the acquisition of Dysan, maker of both rigid and floppy disks, Xidex was in only two businesses, floppies and computer microfilm. Now it is further strengthening its position in rigid disks with a pending acquisition of Charlton Associates of Irvine, Calif., a company in which Dysan was a major stockholder. Xidex announced an agreement to buy Charlton last November.

In December, Xidex agreed to acquire Trimedia, the Fremont, Calif., maker of sputtered thin-film rigid media, and it completed acquisition of the magnetic media portion of Control Data's Business Products Group. The former CDC operation manufactures and markets disk packs, computer tape, and flexible diskettes at facilities in Omaha and Lincoln, Neb., and Brynmawr, Wales.

Xidex's international sales grew to $56 million last year from $37 million in fiscal '84. A factory in Le Locle, Switzerland, produces most of Xidex's floppy disks sold overseas. In view of its tax-protected status in Switzerland, the company is exploring the possibility of manufacturing other products there.

The memory products maker has wholly owned marketing subsidiaries in 10 countries outside the U.S. and has manufacturing facilities in Ireland, Puerto Rico, and Australia, in addition to Switzerland.

Xidex is operated by a triumvirate: Lester L. Colbert Jr., chairman and president; Bert Zaccaria, executive vice president; and Gary Filler, chief financial officer. Emblematic of Xidex's lack of extravagance, the three top officers share one secretary.

70

DIEBOLD INC.

818 Mulberry Rd. S.E.
Canton, OH 44711
(216) 489-4000

"Challenging" is what Diebold president and ceo Robert W. Mahoney called 1985. Others might be less sanguine. In truth, 1985 for Diebold was, at best, difficult.

Diebold reported net sales for 1985 of $410.9 million and net income of $30.4 million, down significantly from 1984 figures of $474.1 million and $56.9 million. The company attributed the slack to conditions in the financial industry, its primary target for automated teller machines. Also cutting sales were a flurry of mergers and acquisitions, deregulation, and the shift from proprietary to shared networks for ATMs and point-of-sale terminals.

On the bright side, Diebold's overall fourth-quarter sales, in terms of orders received, were the best for the entire year.

Manufacturing backlogs also took a drubbing, standing at $87.7 million on Dec. 31, 1985, compared with $114.3 million at the same time the previous year. About $12 million of the shortfall was caused by cancellation of an order with National Transactions Systems, a Los Angeles firm that went out of business.

During 1985, between 8,000 and 8,500 ATMs were delivered overall in the U.S. market, a decline of more than 25% from the previous year. Diebold predicts, however, that the industry's merger mania will lead to bigger, healthier institutions looking for more hardware and software to bolster their delivery systems. Also driving the market are the 120 million ATM debit cards already issued to consumers.

To meet this far more positive challenge, the company introduced the 1000 Modular Delivery System family of self-service systems for the financial and retail industries, adding additional capabilities to the TABS 9000 ATM systems, the best-selling ATMs in the U.S.

The company introduced the React 1 credit authorization terminal and retail versions of the 1000 Modular Delivery System. The new devices add services designed specifically for retailing, mass merchandising, and the travel/hotel market. Diebold is attempting to interest department stores in using the 1050 Interactive Video System—a part of the React 1 family—as a "store within a store," augmenting or replacing the catalog desk. The system incorporates laser disk, touch screen, and pc technologies and automates a variety of traditional sales and services functions.

71

SANDERS ASSOCIATES INC.

Daniel Webster Highway S.
Nashua, NH 03061-0868
(603) 885-4321

Difficulties with its defense electronics business and the slump in the computer industry gave Sanders Associates a mediocre year. Revenues dropped by nearly 13% to $783.8 million. While computer-related revenues rose 24% to $323.4 million, the increase didn't meet company expectations. Most of the increase was due to a sharp rise in the company's maintenance and repair service income, which soared to $23.4 million, compared to $5.8 million the year before.

Sanders had no trouble getting defense contracts last year, just in carrying them out. Production problems arose with products it was building for the Navy and Air Force, and inventory problems held up another Air Force order as well. Too, the military is putting the squeeze on profit margins of suppliers. Profits fell 61% on Sanders' military business in the fiscal year that ended July 26, 1985, and the business hasn't yet turned around.

Meanwhile, there was stiff competition in the computer graphics business conducted by Sanders' subsidiary, the CalComp Group. But the business was paced by a 40% increase in shipments of plotter devices—nearly 6,000 went out the door—and the popularity of the company's newest model, the 1040 pen plotter, aimed at the microcomputer-based, computer aided design market.

The company introduced a new graphics workstation, the Vistagraphic 4500MV, designed for use with DEC's MicroVAX II. It was the third member of a family of products it sells to oems, the largest of which, IBM, last year accounted for $141.7 million of the company's sales.

Last year CalComp acquired the architectural, engineering, and construction division of P-CAD, a manufacturer of computer aided design software for personal computers, at a price of $7.5 million. CalComp also acquired, for $5.5 million, Terak Corp. of Scottsdale, Ariz., a maker of color graphics displays and workstations. It also bought Image Resource Corp. of Westlake, Calif., for $3.4 million, to get a toehold in the market of high-resolution, color business presentation graphics.

During the year, Sanders Associates stepped up its R&D spending by 2%, to 5%. The company maintains that this increased spending, together with strategic acquisitions, will enable it to weather an expected falloff in IBM purchases of Sanders' graphics products.

72

SHARED MEDICAL SYSTEMS CORP.

51 Valley Stream Pkwy.
Malvern, PA 19355
(215) 296-6300

In 1984, changes in the hospital industry had worked to SMS's advantage. Limited reimbursements had made hospitals more aware of costs than ever before. The demand for information systems had increased dramatically, and business for SMS had boomed. These same changes made life a little more difficult in the first quarter of 1985: SMS experienced a slowing in the rate of new customers and lowered usage of remote services. A long streak of consecutive quarterly earnings-per-share improvement came to an end. Nevertheless, revenues were up 22% from 1984 to $312.2 million, and profits were up 23% to $41.7 million.

By year-end things looked brighter and SMS was doing so well that Morgan Stanley included it in the investment firm's model portfolio. Analysts at Morgan Stanley attribute SMS's success to its large, recurring revenue stream, unbundled product support of IBM configurations, and increasingly aggressive marketing strategy.

Although actual processing per patient is on the rise, declining occupancy levels and shorter patient stays restrict the amount of processing that hospitals can do through remote services. SMS responded by beefing up its product line with more on-site and turnkey products.

In March, SMS acquired Computer Synergy Inc., a small West Coast-based vendor of turnkey financial systems that operate on DEC VAX superminicomputers. SMS and CSI merged their DEC-based software systems to create a new turnkey product, called Spirit, which provides small and midsized hospitals with an integrated financial and patient care system based on a single technology.

Other applications SMS introduced this year include products for nurse staffing, nursing care plans, cost accounting, advanced materials management, scheduling, and a new IBM-based pharmacy system. SMS continues to do business overseas through its affiliate SMS International, which provides services to hospitals in the United Kingdom, Ireland, the Netherlands, Spain, Japan, and West Germany.

73

M/A-COM INC.

7 New England Executive Park
Burlington, MA 01803
(617) 272-9600

High flying M/A-COM inched closer to the $1 billion sales barrier in 1985, but ended the year under a cloud. Profits began to plunge in the second half of the year as trouble brewed in several major markets. While revenues were up 7.6% to $855.2 million from 1984's $794.3 million, net income dipped 18.3% to $32.6 million from $39.9 million. Dp revenues were up 22.1%, rising to $305.4 million last year from 1984's $250 million. But worse could be in store this year. The company was predicting a $55 million loss in the first quarter of 1986 and now plans to discontinue some of its operations. It seems inevitable that this widely diversified communications company will undergo a major restructuring in 1986 in an effort to control costs.

M/A-COM has invested heavily in some markets, such as scramblers and unscramblers for pay television companies, that won't become profitable until 1987. The company has won big contracts in the satellite communications area that also won't bear fruit for a number of years.

M/A-COM has other problems. Various constraints have led the federal government and its military contractors to delay buying equipment. U.S. semiconductor companies have been hit hard by the Japanese and are buying less from M/A-COM's microwave components operation. The company's backyard satellite earth station business has declined due to increased competition, creating problems of overcapacity. And in its data communications division, sales to U.S. telecommunications companies have slowed because of the increasingly widespread use of fiber optics.

Several other businesses acquired during M/A-COM's aggressive expansion program of the past six years have been slow to develop, and here, too, the company is looking at whether assets should be downvalued.

74

APOLLO COMPUTER INC.

330 Billerica Rd.
Chelmsford, MA 01824
(617) 256-6600

Two years ago Apollo Computer brought in professional manager Thomas Vanderslice, a veteran of top jobs with both General Electric and GTE, to manage the company's dizzying growth as a supplier of computer workstations. In six years, Apollo's revenues have gone from zero to $295.6 million in 1985.

But 1985 turned out to be a year of confused direction: while the company controlled 38% of its market and reported an impressive 36.9% revenue growth, its earnings skidded into the negative column and the company posted its first loss ever, $1.5 million for the year.

Vanderslice said he'd installed an infrastructure that "could easily accommodate the kind of growth that industry watchers had projected for 1985." But growth failed to meet his expectations: many customers weren't buying at all; others deferred purchases, awaiting new products from Digital Equipment Corp. and IBM.

Most of Apollo's revenue growth occurred in the first half, before IBM and DEC released their own workstation products. Apollo revenues dropped nearly 7% in its fourth quarter.

The computer workstation market, which Apollo pioneered, continues to grow, however. Market research figures estimated it at $1.3 billion this year, double last year's mark. Apollo sees its best opportunity in large technical organizations where engineers use workstations to perform many kinds of jobs, such as computer aided design, software development, and experiments with artificial intelligence concepts.

Early this year the company announced replacements for its entire line of workstations. At the lower end it offered a 32-bit monochrome Series 3000 personal workstation for $9,000 and a color version priced at $14,900. At the upper end, the company began offering the DN 750 and DN 780, priced at $29,000 and $43,900 respectively. Apollo said each system offered more performance than a product announced by Digital Equipment Corp., called the VAXstation II/GPX. Apollo also brought out a high-speed computer, priced at $195,000, for use in high-speed computations in networks of its engineering workstations.

It announced an agreement with Texas

Instruments to develop software that would link Apollo's Domain (for Distributed Operating Multi-Access Interactive Network) with TI's Explorer workstation, a Lisp-based artificial intelligence processor.

75

3M

3M Center
St. Paul, MN 55144-1000
(612) 733-1110

Although data processing activity represented a mere 3.7% of giant 3M's worldwide sales of close to $8 billion, the computer slump was a significant factor in the company's disappointing results in 1985. Dp revenues were up only slightly, rising 4.9% to $295.4 million from 1984's $281.4 million. Worldwide sales of $7.8 billion represented an increase over the year before of only 1.8%; earnings dropped 9.4% to $664 million, from 1984's $733 million.

"Our results were below our long-term objectives," was the way since-retired chairman and ceo Lewis W. Lehr explained 3M's performance in a year of slow growth and adverse currency effects. These were but two factors contributing to slow growth and disappointing profits. The computer slump, intense price competition in computer diskettes, and a $50 million charge to fund a joint venture in the office products business were the key computer-related drains on income.

The joint venture was with Harris Corp. to sell and service copiers and facsimile machines through an independent company called Harris/3M Document Products, Inc. The company suffered some disappointments in the documents moving field, having dropped its electronic documents transmission system, called Whisper Exchange, only a year after it was on the market.

But it has since announced major new products, including optical media for electronic document systems and new software to facilitate the handling of office and engineering documents. It has also introduced a laser printer and reader printers that use ordinary sheets of paper.

The company says it is making "good progress" on optical recording technology, which it expects to become a billion-dollar market in the 1990s.

The company's memory technologies group again had to face tough price competition, much of it due to disappointing personal computer sales. It has made little progress on a highly touted "stretched disk," made of a flexible magnetic material stretched and bonded to a rigid substrate made of polyethermide. The result is a hybrid of a floppy and a Winchester rigid disk.

3M's new chairman and ceo is Allen F. Jacobson, 59, former president of the company's U.S. operations.

76

MITEL CORP.

350 Legget Dr.
Kanata, ONT K2K 1X3
Canada
(613) 592-2122

Take an infusion of money, a better accounting method, a new president, and a well-received new product, add them to a company that was once one of Canada's premier advanced technology companies, and what do you have? If the company is Mitel, the answer is still "wait and see."

Mitel's sales crept up last year to $294.8 million (U.S. dollars), but it still languished in the losing column. Even so, losses of $23.1 million were an improvement over 1984's $44.7 million bath. Further help may come from British Telecom, which bought 51% of the company in April 1986.

There is fierce price-cutting in the office switchboard market (PBX) at a time when research costs are soaring. Mitel also was hurt by delays in building its newest product, an integrated voice and data exchange called the SX2000. Although the machine has been well received and SX2000 sales are growing, shipments are dwarfed by such large competitors as AT&T, Northern Telecom, and Rolm Corp.

To penetrate the office automation market, Mitel needed a partner, but a brief interlude with IBM in 1984 ended when IBM opted to court Rolm instead.

When British Telecom bought a controlling interest in the company for $250 million, its first change was to name a new president, Anthony Griffiths, a former member of Mitel's board. Griffiths overhauled what financial observers have long considered to be a sloppy accounting system, and stepped up marketing of the SX2000. Part of the strategy centralized worldwide PBX operations management in the company's headquarters near Ottawa. Griffiths formed a senior management team of five executive vice presidents within the PBX division that will have worldwide responsibilities for operations, sales, and marketing, R&D, finance, and management controls.

Financial analysts think that British Telecom will beef up Mitel's R&D expenditures, which had declined by a third in the 1985 fiscal year. While BT's English distribution network may help Mitel's U.K. sales, BT acquired the Mitel interest primarily to gain a foothold in the U.S. market.

77

FERRANTI PLC

Bridge House, Park Road, Gatley
Cheadle, Cheshire SK8 4HZ, England
(44-61) 428-3644

It wasn't smooth sailing last year for electronics companies trying to navigate in the choppy British economy. But Britain's real-time specialist Ferranti managed to keep its head above water: at the end of last year, the firm recorded dp revenues of $282.1 million (£220 million), up 6% over 1984. Total corporate revenues were off 2.6% to $737.2 million (£575 million). Nevertheless, profits were up 29.9% to $38.6 million (£30.1 million).

The weak link in Ferranti's product lineup, which includes computers, telecommunications, and defense systems, has been chips. But despite the slump in semiconductors, the company, which specializes in gate arrays, has continued to plow money into production. In the dp arena last year, Ferranti unveiled the PC 850, a PC-compatible micro that chalked up $7 million in sales in its first six months on the market. Most of those sales were made in conjunction with larger control systems contracts.

Ferranti's biggest dp customers are in the oil business. For example, about 60 of the firm's Argus 1100 minis are used in the North Sea oil fields, off the British coast. These machines are also at work in the chemical, food, steel, and power industries. More recently Ferranti moved into the air traffic control market, winning a $10 million order from Swissair.

Ferranti Infographics, the company's CAD/CAM arm that opened a U.S. office in 1984, has found the going tough: it has not yet nailed a major order. Back in Britain, however, where Ferranti Infographics announced a low-end addition to its CAM-X range of systems, the company has recorded growth of 90% in sales.

Roughly 60% of Ferranti's total business is derived from the defense sector. Ferranti, as a matter of fact, is the major supplier of processor power to the British navy. Over the past 12 months, the company has won a $10 million contract to supply processors for a new class of small, British diesel submarines.

78

CONTINENTAL TELECOM INC.

245 Perimeter Center Pkwy.
Atlanta, GA 30346
(404) 391-8000

"I'm a big believer that one of the great things in life is change." These are the words of Contel president John Lemasters.

Well, the guy must be having one hell of a time. Since becoming the first Contel president to come from outside an operating company, Lemasters has replaced almost every manager in Contel's nonregulated enterprises, reorganized that nonregulated business into four sectors, and changed Contel's mind-set from complacent to competitive.

Almost all the new managers came from Harris Corp., where Lemasters worked for 26 years. He had been senior vice president and executive of Harris's Communications sector when he left the company in 1984 to

See your
TeleVideo distributor.

CALIFORNIA
TELEVIDEO REGIONAL
SALES OFFICES
Sunnyvale (408) 745-7760
Newport Beach (714) 476-0244
D.H. MINICOM
Los Angeles (213) 483-2400
DAVID JAMISON CARLYLE CORP.
Culver City (213) 410-9250
DIGITAL SOURCE, INC.
San Diego (619) 569-9333
DUCOMMUN DATA SYSTEMS
Cypress (714) 220-6588
EMERITUS
Fresno (800) 325-9892
KIERULFF ELECTRONICS, INC.
San Jose (408) 220-6300
LEASAMETRIC
Foster City (415) 574-4441
PREMIER SOURCE DISTRIBUTING
Irvine (714) 261-2011
RC DATA
San Jose (408) 946-3800
U.S. INSTRUMENT RENTAL
San Mateo (415) 572-6600
VIVITAR COMPUTER PRODUCTS
Santa Monica (213) 829-3672
WESTERN MICRO SYSTEMS
Mountain View (415) 964-2050
FLORIDA
GENTRY ASSOCIATES
Orlando (305) 859-7450
GEORGIA
TELEVIDEO REGIONAL
SALES OFFICE
Norcross (404) 447-1231
INFOTEC, INC.
Atlanta (404) 458-1400
ILLINOIS
TELEVIDEO REGIONAL
SALES OFFICE
Schaumburg (312) 397-5400
DATA ONE
Prospect Hts. (312) 520-1300
PRO COM SALES
Elk Grove Village
(312) 860-1123
TEK-AIDS INDUSTRIES
Arlington Hts.
(312) 870-7400
UNITED STATIONERS
Forest Park (312) 699-5000
INDIANA
NASH & ASSOCIATES
Indianapolis (317) 925-1050
MARYLAND
FEDERAL DATA CORPORATION
Rockville (301) 294-9682
MASSACHUSETTS
TELEVIDEO REGIONAL
SALES OFFICE
Woburn (617) 890-3282
ARROW ELECTRONICS
Woburn (617) 938-8700
BUTLER ASSOCIATES, INC.
Newton (617) 964-5270
STRATUS COMPUTER
Marlboro (617) 460-2000
MICHIGAN
MIDCOM COMMUNICATIONS
Southfield (313) 353-5696
STAR-TRONIC
Farmington Hills
(313) 477-7586
MINNESOTA
AVNET COMPUTER TECHNOLOGIES
Eden Prairie (612) 944-1114
BENCHMARK COMPUTER SYSTEMS
Minneapolis (612) 831-2300
PC EXPRESS
Burnsville (612) 894-9153
NEW JERSEY
DATA STORE
Cherry Hill (609) 779-0200
NEW YORK
TELEVIDEO REGIONAL
SALES OFFICE
Syosset (516) 496-4777
ARROW ELECTRONICS
Melville (800) 323-4373
MANCHESTER EQUIPMENT
COMPANY
Hauppauge (516) 435-1199
TRANSACTION CONCEPTS, INC.
Forest Hills (718) 544-8898
TRICOM GROUP
W. Hempstead (516) 483-9700
NORTH CAROLINA
PEN-TECH SALES
Greensboro (919) 852-6000
OHIO
COMPUTER PLACE
Brooklyn Heights
(216) 351-7444
E.Q.S. SYSTEMS
Chesterland (216) 729-2222
REYNOLDS & REYNOLDS
Dayton (513) 443-2264
W.C. KOEPF & ASSOCIATES
Chargin Falls (216) 247-5129
OREGON
OMEGA DATA, INC.
Hillsboro (503) 640-3995
PENNSYLVANIA
ARCH ASSOCIATES
Fernwood (215) 284-0327
TEXAS
TELEVIDEO REGIONAL
SALES OFFICE
Irving (214) 550-1060
CARTERFONE COMMUNICATIONS
Dallas (214) 630-9700
INTERPRINT, INC.
Austin (800) 637-0600
INTERPRINT, INC.
Houston (713) 465-0580
INTERPRINT, INC.
Plano (800) 527-5113
MICRO SOURCE OF TEXAS
Richardson (214) 690-5111
US DATA CORPORATION
Richardson (214) 680-9700
WASHINGTON
DATEC, INC.
Seattle (206) 575-1470
DYNAMIC SYSTEMS NORTHWEST
Mukilteo (206) 745-5311
VIRGINIA
MARVA DATA SERVICES
Falls Church (703) 893-1544
CANADA
ARROW ELECTRONICS
CANADA LIMITED
Montreal, Quebec
(514) 735-5511
COMPUTER DISTRIBUTION, INC.
N. Vancouver, BC
(604) 984-0641
DATAMEX LIMITED
Montreal, Quebec
(514) 355-4923

TeleVideo®
Settle for more.

head American Satellite Co., a joint venture between Contel and Fairchild Industries. Lemasters tapped his former firm for six new Contel executives in the last six months of 1985.

They became the main men in Contel's four divisions. Business Systems provides voice communications and data processing products and services for small- to medium-sized business customers. Federal Systems builds telecommunications and dp systems for U.S. and foreign governments. Information Systems serves private sector customers who need complex telecommunications and dp systems and services. Telephone Operations is still the foundation, with 2.2 million customers in 31 states; its revenues are the tenth largest in the industry.

Consolidated net income leaped 23% to $240 million from $195 million in 1984. Revenues rose only 6% to $2.56 billion from $2.40 billion. Net income was somewhat skewed by the sale of Mast Advertising and Publishing, Contel's directory business, to Southwestern Bell for $120 million. The total gain was $41.6 million.

Contel disposed of two other activities that Lemasters told a group of analysts did not "fit into the long-term future" of his company. National Bancard Corp., Contel's credit card clearing company, was sold to that company's management. STSC, a software operation originally bought as a timesharing company, was also sold to its own management.

The company wasn't only in a selling mode. It acquired Fairchild's portion of American Satellite and Space Communications Company (Spacecom). It also launched a new subsidiary, Contel Tenant Services Inc. (CTSI). CTSI will design, market, install, and manage shared-tenant services facilities nationwide.

79

BOEING COMPANY

7755 East Marginal Way S.
Seattle, WA 98108
(206) 655-2121

Data processing accounts for less than 3% of Boeing Co.'s total revenues. So while the company as a whole had record sales of $13.6 billion, with earnings of $566 million, DATAMATION estimates that Boeing's dp business was up only 3.8% to $270 million.

Along with a newly formed Boeing Electronics company, which consolidates the manufacture of digital controllers, processors, data buses and automated test systems for use internally and to some commercial and government customers, Boeing Computer Services Co. (BCS) is Boeing's sole source of data processing revenue.

Last year, Boeing reorganized the BCS operation into two organizations, one that aims at government customers and the other at commercial customers. The commercial operation, called Commercial Infor-

IS THIS A PROJECT HEADED FOR TROUBLE?

You don't know. What you see looks fine. It's what you don't see that's the problem.

Example: A key supplier is closing its doors. A new source has to be found. Deliveries will be delayed and costs will increase.

With the limited visibility of the above graphics, it could be weeks before the impact is displayed. There will be long delays in the schedule and cost overruns. The project is in real trouble!

This situation could have been avoided with VIS1ON...a powerful, comprehensive, easy-to-use project management system.

Using VIS1ON, the project's schedule and costs can be updated as soon as events occur. You actually see what effect they have on your project tomorrow, next week, next month.

VIS1ON also provides you with a powerful "What If" capability that helps you analyze problems and find solutions.

VIS1ON helps management see behind the lines and into the future. That's why so many of the Fortune 1000 companies depend on VIS1ON to help keep their projects on time and within budget.

Find out how VIS1ON can help keep your project out of trouble. Call or send for more information today!

VIS1ON is available on DEC VAX and PR1ME minicomputers.
VIS1ONmicro now available on IBM® PC.

Now available on IBM mainframe

SYSTONETICS

801 E. Chapman Ave., Fullerton, CA 92631 • (714) 680-0910 • Telex 692-327

DOMESTIC OFFICES: Fullerton, CA (714) 680-0910 • San Jose, CA (408) 275-0890 • Seattle, WA (206) 455-3374 • Denver, CO (303) 740-6681 • Houston, TX (713) 461-3905 • Atlanta, GA (404) 955-7740 • Oakton, VA (703) 359-2982

INTERNATIONAL AGENTS: EURO/LOG HOUSE, 25 High Street, Rickmansworth, Herts WD3 1DF, United Kingdom, Phone 923-777007, Telex: 917099 • Software Solutions Pty, Ltd., 5 Alexander Street, Crows Nest, New South Wales, Australia 2065, Phone: 2-439-3055, Telex: AA72618 • Optiim Scandinavia A.S., Lumberveien 13, P.O. Box 210, N-4620 Vagsbygd, Norway. Phone: 47-42-14200. Telex: 21603.

IBM is a trademark of International Business Machines Corporation

CIRCLE 94 ON READER CARD

Your family's savings program is unique. You have different needs. And different concerns. That's why so many families have made U.S. Savings Bonds their family bond. It's the bond that holds a family's savings program together.

That's because bonds offer so many guarantees. Guarantees that are just right for any family. Like guaranteed interest return. Guaranteed tax benefits. Guaranteed safety. And all backed by the most solid guarantee of all. America.

So, when you're looking for that bond as unique as your savings needs, look to U.S. Savings Bonds. They really are the Family Bond.

Take stock in America.

mation Systems, is aiming its professional and technology resources at the energy and manufacturing markets. BCS also trimmed some operations, reducing the number of sales field offices to 10.

This year BCS began developing AI workstations for software engineers, an effort that the company says could increase productivity threefold. BCS also signed on with GM's Technical and Office Protocols (TOP), the automaker's big move for office automation standards.

Boeing Electronics is deeply involved in microelectronics R&D and last year joined the Microelectronics and Computer Technology Corp., Admiral Bobby Inman's Austin, Texas, consortium that does advanced research in advanced microelectronics technology.

80

GOULD INC.

10 Gould Center
Rolling Meadows, IL 60008
(312) 640-4000

The big news over in Rolling Meadows is not much news to the rest of the world: Gould survived the year, and it didn't merge. After hoping that 1985 would show the positive results of an ambitious five-year overhaul, management must have been pretty disappointed with the year. Revenues of $1.4 billion were up a meager 1.5% from the year before. Income suffered, due mainly to discontinued operations, sinking to a $175.7 million loss from a $17.8 million profit the year previous. After playing footsie with Siemens of West Germany, Gould agreed only to a deal for a joint telecom equipment venture, to begin this year.

The bright spot was dp revenues, which jumped another 20% last year, to $269.4 million from $224.5 million the year before. The Information Systems segment, responsible for the line of 32-bit superminis, outperformed all the other Gould units. The company received a $50 million, four-year contract for 103 Unix-based PowerNode systems for use by the Defense Logistics Agency; and it introduced three new supermini models and software, and several new image processing products.

As Gould sold off the last of its nonelectronic businesses, it announced a new single sales organization that combines the sales groups of the three divisions that serve the industrial automation market. The company hopes to target this market, and announced two products geared toward it: the NW 0200 MAP Gateway, designed to integrate diverse segmented manufacturing systems along MAP backbone networks; and the UTX/32 software, which is designed to allow each Gould PowerNode computer in a MAP network to serve as a full node.

Despite its much-touted streamlining and positioning itself for the future, Gould has, so far, found 1986 to be dismal. Following the announcement of a 26% first-quarter drop in earnings, chairman and ceo William T. Ylvisaker reportedly was considering resigning.

81

TANDON CORP.

20320 Prairie St.
Chatsworth, CA 91311
(818) 993-6644

Tandon Corp.'s unique double-sided disk drives for micros made it wildly successful until Japanese and Korean firms decided the company's turf looked attractive. Sales plummeted last year, Tandon went before the International Trade Commission, charging patent infringement, and, when 1985 drew to a close, the numbers showed Tandon had been very badly wounded indeed. Net sales for fiscal 1985 were $268.8 million compared with $398.5 million the previous year. For fiscal 1985, following tax credits of some $31 million, the company had a net loss of $135.4 million. This compared with net income of $29.4 million in 1984.

Tandon went into the offensive early in the year, charging almost two dozen Japanese and Korean firms and their subsidiaries with poaching upon its patented technology and then deliberately undercutting Tandon's prices. "They're simply not playing on a level field," is how Ranjit Sitlani, vice president of the firm, put it after he unleashed a battery of lawyers on the opposition. Some quick, out-of-court settlements helped. Without admitting liability, the Sony Corp. and Teac Corp. coughed up undisclosed cash settlements and additional monies for licensing fees. Mitsubishi Electric Corp. refused to cut a deal, however, and the International Trade Commission in Washington, D.C., eventually ruled in that vendor's favor. Still left simmering are a number of separate civil suits which may come to fruition in a year or so.

Perhaps with one eye to the future, Tandon began to diversify on grounds that the disk drive market—double-sided or conventional, hard or floppy—was no longer bringing in high profits to anybody. The firm announced a $300, three-year deal with two unspecified firms to oem micros and assorted disk products.

Here, Tandon will develop a family of XT- and AT-compatible workstations using Intel 80286 chips. Other new products included the card-mounted, plug-in Diskard, to be sold through retail outlets and offering 21.3MB of formatted capacity for IBM PCs, XTs, or other compatible micros.

The company also brought in some new faces. Dan H. Wilkie, who headed IBM's micro facility in Boca Raton, Fla., was named Tandon's ceo. Earlier, the company hired H.L. Sparks, author of IBM's PC marketing strategy, to become Tandon's vice president of sales and marketing. Charles Paddle, formerly chairman of Victor Technologies, was hired to expand Tandon's European operations.

As the year drew to a close, it became apparent to many that its disk drive operations would account for no more than one third of Tandon's future efforts. Steven L. Ossad of L.F. Rothschild, Unterberg, Towbin, the company's investment banker in New York, speculated that his client will be soon building its own Tandon-label micro for sale to both the public and office markets, a strategy not without high risks of its own.

82

NBI INC.

3450 Mitchell Lane
Boulder, CO 80301
(303) 444-5710

NBI began 1985 with promising news. An announcement in January of a proposed $162.7 million acquisition of Computer Consoles Inc., a Rochester, N.Y., supplier of office computer and telephone systems, had the *Wall Street Journal* mentioning NBI in the same breath with "such second-tier office automation companies" as Data General and DEC. Less than a month later, however, the proposed acquisition was off, with NBI citing differences between the two firms "ranging from strategy and philosophy to operations."

After the deal fell through, the reasons for NBI's interest remained. The 12-year-old company has had trouble matching the success of its standalone word processors in the newer market for the integrated office systems, and as a result its financial performance has been spotty. After rebounding in 1984 from disappointing profits reported in 1983, NBI's 1985 earnings dropped 45% to $7.9 million on revenues of $260.7 million.

Wall Street had viewed the proposed acquisition of Computer Consoles as an indication that NBI sought to boost its expertise in high-end office systems, but apparently NBI chairman and founder Tom Kavanagh has other plans for repositioning the company. In June, NBI completed the acquisition of a West Coast distributor of office supplies, Seattle, Wash.-based Yukon Office Supply; it was part of a continuing strategy Kavanagh has described as "balancing the more volatile computer business with more stable and predictable revenues from office supplies."

Analysts seem to view NBI's moves in the office supply field favorably while questioning how paper clips fit into the company's product line. In the high-tech arena, NBI's direct-sales force, which numbers nearly 200 in over 40 offices in the U.S. and Canada, is considered a valuable asset.

Additions to NBI's product line last year included various controllers and links that enhance the OASys line of office automation systems and a new system for electronic publishing. Sales of NBI's high-end systems continue to be soft, however, and in the first quarter of fiscal 1986 the company reported larger than expected losses for its Integrated Solutions subsidiary, which markets engineering workstations.

Meanwhile, at last November's annual meeting, shareholders approved two anti-takeover measures. According to NBI spokesman Jesse Simmons, no takeover offers have been tendered for the company.

83

PERKIN-ELMER CORP.

761 Main Ave.
Norwalk, CT 06859
(203) 762-1000

This diversified technology company continued its attempts to expand its share of the superminicomputer market. The company tried to give its Data Systems Group greater clout in the market—and with investors—by spinning off the Holmdel, N.J.-based minicomputer operation as a partially owned subsidiary.

The new company, Concurrent Computer Corp., is managed by the same executives as before, but has sold about 17% of its stock to outside investors; the managers themselves purchased a 1% stake. Perkin-Elmer controls the other 82%. DATAMATION estimates Concurrent had 1985 revenues of $259 million, which was 11% over the division's 1984 performance.

Concurrent's major markets remain the same: aerospace and defense, training simulation, health services, manufacturing, financial services, and the mining and petroleum industries. The company reorganized its marketing into two broad categories–real-time and transaction processing.

Meanwhile, it added several new models to its 3200MPS family of 32-bit computers. The introduction of models 3230, 3260, and 3280 rounded out the product line from bottom to top. Also, enhanced Reliance transaction processing software was brought out to help move the machines into commercial markets.

As the name Concurrent implies, the company's computers are multiprocessing computers that segment tasks for execution on different processors. The company bills itself as a leader in the as yet unsettled area of parallel processing.

James K. Sims, former group executive of Data Systems, was elected senior vice president and later named president and ceo of the new Concurrent.

84

MAI BASIC FOUR INC.

14101 Myford Rd.
Tustin, CA 92680
(714) 731-5100

MAI Basic Four returned from the dead in 1985. After being caught up in a vicious proxy fight over ownership during 1984, Management Assistance Inc. sold the MAI Basic Four arm of its company to Bennett S. LeBow, a private investor. The sale ended one of the bitterest takeover battles on record.

The "new" MAI Basic Four reports that it conducted no significant business activity during 1984, and therefore no comparable results are available. The results for 1985 put the company firmly in the black with net income of $8.2 million on revenues of $252.8 million. These earnings are truly remarkable, considering that under Management Assistance Inc. they were a sickly $1 million in 1984.

MAI Basic Four indeed has a new lease on life, having moved operations from New York City to California. The company's products—the MAI 2000, a 16-bit multiuser micro, and the 32-bit MAI 8000 multiprocessor supermini—are new from top to bottom.

Basic Four was a pioneer in the small business market and has an installed base of over 30,000 units. During 1985, MAI Basic Four sold $84.3 million in minicomputers and was helped considerably by $106.7 million in sales of peripherals. Maintenance and repair, which was once handled by Sorbus, is now in-house, producing revenues of $38.2 million during the year.

85

PARADYNE CORP.

8550 Ulmerton Rd.
Largo, FL 33540
(813) 530-2000

Call it the year of living dangerously. Just when this communication network supplier thought it had made peace with the government, the parties were at war again.

The campaign apparently took its toll on Paradyne's balance sheet. Revenues fell 13%, from $298.9 million to $252.5 million. But that was an upper compared with net income. That item plunged 383%, from a profit of $11 million in 1984 to a loss of $31.1 million in 1985.

Paradyne and the Securities and Exchange Commission (SEC) waved white flags in September, ending the legal skirmishing that had begun in 1983 when the SEC sued Paradyne for "fraud and deceit" concerning the company's $100-million 1981 contract with the Social Security Administration (SSA). The contract was the largest awarded by the SSA and the largest won by Paradyne. The settlement came the day before the suit was scheduled to go to trial.

But there were more tribulations for Paradyne. Chairman Robert Wiggins and seven other company executives were charged in December with fraud in a 14-count indictment stemming from the same case. Shortly thereafter, Jerry Kendall and Fred Melberg, neither of whom were indicted, were named executive vice president and chief operating officer, and executive vice president and chief staff officer, respectively.

After the indictment the Department of Health and Human Services barred Paradyne from receiving any further federal government business for 12 months or until there is a verdict in the fraud trial. And while the SEC may be history, a class action suit brought following the SEC's complaint is still pending.

Ironically, the suspension doesn't affect Paradyne's current government business, which accounts for about 10% of the company's overall revenues, the SSA contributing half of that figure. And the SSA had already renewed a $12.4 million contract with Paradyne for support of its installed terminals in 1986.

"It's difficult to put our arms around how much this has cost us in getting new business," director of corporate communications Miriam Frazer says. In legal fees, the disagreement has cost Paradyne $6.5 million over three years.

"It certainly made it more difficult to initiate new accounts," Frazer says. "But we did get 80% repeat business."

The outlook for 1986 is, not surprisingly, more positive. Analysts estimate revenues of $285 million, which would return the company to near-prelitigation levels.

"The integrity of the company is critical, and we're going to fight for it," Frazer promises. "It's the right thing for the [illegible]pany and the shareholders. Even if [illegible] indicted people are removed, the company will go on."

86

PLESSEY CO. PLC

Vicarage Lane, Ilford
Essex, 1G1 4AQ, England
(44-1) 478-3040

Plessey lost a $7 billion contract and gained a $1.7 billion suitor in short order last year. The lost business, for a U.S. Army battlefield communications system, sparked off debate about the special relationship between Britain and the U.S., while the suitor, General Electric Co. plc (GEC), failed to spark anything but animosity.

It was a difficult year in dp for Plessey: DATAMATION estimates dp revenues fell 14% to $250 million (£195 million). A lot of the bad news came from Plessey's ailing peripherals division, which continued to pile up losses for the fourth consecutive year. Things weren't much better on the telecom side. The company's flagship product, the System X digital exchange, has yet to pay off for Plessey. Beset by software snafus and sluggish orders from British Telecom, the switch should do better this year now that BT purchases are picking up. Another piece of good news last year was a joint field trial of PBX equipment with South Central Bell.

Across the Atlantic, things are still looking down at Plessey's U.S. subsidiary, Stromberg-Carlson, which continued to be a big drain on the British company's revenues and resources. Last May, Plessey announced that it would be reorganizing the troubled subsidiary and cutting staff. Stromberg-Carlson has also apparently abandoned plans to combine System X with its own DCO exchange.

Ironically, GEC, the spurned suitor, had originally worked on the System X with Plessey. Those ties obviously didn't bind Plessey, which quickly rebuffed GEC's takeover proposal in December. On the defensive, Plessey chairman Sir John Clark countered by offering to buy GEC's share in the System X exchange. GEC chairman Lord Weinstock declined. Then it looked like Racal Electronics would step in and rescue Plessey from the grasp of GEC. That step, however, was never taken and Plessey's fate now rests with the U.K. government's Monopolies & Mergers Commission, which is expected to issue a report on the sticky situation next month.

On the surface, GEC's marriage proposal to Plessey seems quite logical and practical. A merger of the two firms would create a $9.5 billion company that could marshal its resources and know-how to better compete in the worldwide defense electronics and telecommunications markets. While that kind of market potential may look promising on a global scale, the British government fears it could pose monopolistic problems on the home front.

87

CAP GEMINI SOGETI

11 rue de Tilsitt
75017 Paris, France
(33-1) 426-79757

In the year that Cap Gemini Sogeti finally let the public in on a small piece of its action, it didn't disappoint its enthusiastic new shareholders. The French software/services firm boosted net earnings by 34% in local currency to FF127 million ($14.1 million), a 19% increase in dollar revenue to $245 million.

The company's share price on France's over-the-counter market also skyrocketed, going from FF650 ($70) on June 7 to nearly FF1,400 ($180) by year-end. As a result of the popular offering on 10% of the company's capital, Cap Gemini is now valued at around $665 million. The main reason given by the company for offering 10% of its capital on the OTC market was to gain greater credibility as Europe's biggest computer services operation. What Cap Gemini hoped was that the folks in the States would sit up and take notice of the French firm.

Chairman Serge Kampf, who has a controlling interest in the company, has always attached considerable importance to foreign markets, especially America, where Cap Gemini wants to build up its business. Roughly 55% of the group's 1985 revenue was generated outside France. The U.S., which accounted for 27% of revenues in 1984, may have pulled in a smaller share last year due to the depreciating dollar. Cap Gemini was nevertheless very active in the American arena in 1985. It captured contracts to supply two West Coast banks, Bank of America and Security Pacific National Bank, with its Multipro software engineering system.

Earlier in the year Cap Gemini acquired the consulting division of U.S. services company CGA Computer Inc., merging it with its Stateside operation Cap Gemini DASD. The new combined company, called Cap Gemini America (CGA), is expected to rake in about $130 million this year.

Back in Europe, the company bought out Standard Telephones & Cables' 49.5% interest in its British subsidiary, IAL Gemini, which was renamed CGS UK. The group's business in Europe grew last year, especially its videotex ventures. In June, the Danish PTT announced it would use the company's videotex software. Following up a similar contract in 1984 from the Norwegian PTT, the nation's biggest bank, Den Norske Creditbank, placed an order last year with Cap Gemini for banking system software. The big Dutch retail group Unigro also commissioned Cap Gemini to develop a combined dp and videotex system for centralized pricing, payment, and stock control.

Cap Gemini also did well on its home turf. The French PTT last spring awarded the company a joint contract to produce an electronic guide to the nation's numerous videotex services. Cap Gemini, which is taking part in six R&D efforts under the European Community's Esprit program, also became involved last year in another joint European research project, Eureka.

88

STERLING SOFTWARE INC.

8080 N. Central Expressway
Suite 1140
Dallas, TX 75206-1895
(214) 891-8600

At the end of 1984, Sterling Software, founded in 1981, was an $18 million-a-year company. Last August, the company catapulted into the big time with the software industry's first hostile takeover, buying Informatics General, Woodland Hills, Calif. Informatics cost Sterling $140 million. To finance it the company borrowed $100 million and issued $40 million of preferred stock.

That buy, plus the acquisition of Check Consultants Inc. (CCI) in February 1985 and Decision Systems Inc. last October, brought Sterling's 1985 revenues to $238.8 million. The firm's president, Sterling Williams, has predicted that revenues will be in the area of $260 to $270 million for fiscal 1986.

In melding Informatics into its operations, Sterling reorganized into six major groups and 20 divisions, each headed by a president and addressing specific markets in the general business areas of systems software, applications software, and computer-related professional services.

Some operations of Informatics have been taken over by a new subsidiary company, Answer Systems Inc., Woodland Hills, Calif., headed by David Saykally, a former vice president of business development for Informatics. Saykally had left Informatics in 1982 to become president of Context Management Inc., Torrance, Calif., but rejoined Informatics in early '85 as general manager of one of its software divisions.

Answer Systems' operations incurred substantial losses in 1984, but these losses were reduced in 1985 under Saykally and he has said he anticipates a return to profitability and higher revenues in fiscal 1986.

89

LOTUS DEVELOPMENT CORP.

55 Cambridge Parkway
Cambridge, MA 02142
(617) 577-8500

In 1984 Lotus's revenues had leapt 196%, and profits soared 151%, so the company's 44% gain in 1985 revenues, to $225.5 million, looked relatively modest. Even more pallid was the 6% increase in net income to $38 million from last year's $36 million. The reason: neither Symphony nor Jazz—the two most highly touted products Lotus introduced in 1984—turned out to be a hit of the magnitude of 1-2-3.

Jazz's reception was especially disappointing: the company wrote down $6 million for Jazz advertising costs that normally would have been spread out over the product's life, had it been successful. For the time being, Lotus will concentrate on offering what it calls, "value-added upgrades, enhancements, companion products, and product extensions." The company, however, says it will have "very major new products" late in 1987, when a new generation of personal computers incorporating the Intel 32-bit 80386 chip is expected to be in use. These products will include a database management system, a word processing product, and a product to improve the productivity of people working on networks of pcs. Lotus stepped up its R&D activity in 1985, spending $21.2 million, an increase of $6.4 million over 1984.

Last year the company introduced five products that were either acquired or developed in house. One was 1-2-3 Report Writer, developed by Concentric Data Systems. Another was HAL (human access language), acquired when the company bought GNP Development Corp. HAL is being offered as an enhancement to 1-2-3, permitting English commands to be typed into 1-2-3. Spotlight is a desk organizer developed by Software Arts, and Signal is a software/hardware product that receives stock market quotations via FM radio and enters them for further analysis into either Symphony or 1-2-3 spreadsheets.

Lotus released enhancements to both Symphony and 1-2-3 and added a spelling checker and text outliner to Symphony's word processing function. During the year, the company brought out Symphony Link, which connects to a mainframe by emulating an IBM 3270 terminal. It also will offer universal connectivity through a product called Link, under an agreement with its developer, InfoCenter Software Inc.

Lotus began offering nine foreign language versions of 1-2-3 and Symphony for sale in Europe and the Middle East, and in Japan, it established a new subsidiary and concluded a development partnership with Kanri Kogaku Kenkyusho Ltd., a software company.

90

ATLANTIC COMPUTERS PLC

Winchmore House
12-15 Fetter Lane
London EC4A 1BR, England
(44-1) 583-9481

A massive increase in dp revenues during 1985—up by 94% in local currency to £183.1 million ($224.4 million)—puts this British-based computer leasing company in the DATAMATION 100 for the first time.

Formed in 1975 to supply IBM computer systems and services in the U.K., Atlantic Computers now has offices in the Netherlands, West Germany, Sweden, France, and the U.S., and last year added Italy to its list of foreign subsidiaries.

The bulk of Atlantic's business is in lease sales of IBM systems, accounting for more than $170 million of its revenues last year. That was a substantial rise over 1984 when lease sales were $105 million. The company also pulled in almost $50 million from sales of equipment outright, with the remaining revenues coming from lease rentals and sales of future interests in equipment. Around 83% of its business was generated in the U.K., the rest of Europe providing 15% and the U.S., 2%. Atlantic has great hopes for its American future: during its first full year in 1985, the U.S. operation turned a small profit.

In Europe, Atlantic received orders for 12 IBM Sierras during the year and installed nine of them in the U.K. before year-end.

Meanwhile, the company branched out into DEC systems last year, acquiring one of DEC's U.K. distributors, Computer Systems Development (CSD). This addition to Atlantic's portfolio specializes in software and hardware for the manufacturing, distribution, and financial markets. It markets its software products primarily in the U.K., but has a network of 10 distributors around Europe and a U.S. operation, CSD Inc. It also has a joint venture company called Orbi Software, which distributes products based on Data General machines. Atlantic's other interests include Lion Systems Developments, which produces data communications systems, Atlantic Medical, which provides computer-based medical systems, and MPL Power Systems, which supplies power modules for computers and the aviation industry.

Claiming to have been Europe's top independent supplier of IBM systems on a lease basis during 1985, Atlantic is off to a strong start for this year. But the leasing business is volatile and Atlantic is very vulnerable to changes in IBM's policy.

91

SONY CORP.

7-35 Kitashinag 6-Chome
Shinagawa-ku, Tokyo 141, Japan
(81-3) 448-2111

Sony's dp sales slipped an estimated 10% in 1985, due to falling floppy demand in the U.S. Most of the company's dp sales came from microcomputer storage devices. DATAMATION estimates that Sony's dp revenues totaled $221.8 million (¥52.8 billion), representing roughly 3.7% of the giant conglomerate's corporate revenues.

The consumer electronics conglomerate was particularly vulnerable to the U.S. micro downturn, since almost all of its floppy disk drive business is derived from oem contracts with major U.S. dp manufacturers such as Hewlett-Packard and Apple.

Nevertheless, since IBM has blessed its 3½-inch floppy disk drives, Sony still seems assured a solid niche as an oem supplier. As the industry leader in the 3.5-inch floppy market, Sony has room to price its wares competitively, maintain market share, and develop follow-on products. A high-density format developed by the giant corporation has increased disk recording capacity to 2MB, and Sony hopes that its CD-ROM hardware will become the successor to Winchester disk drives. On the micro system front, Sony produces an 8-bit machine based on the MSX standard; it has not attracted a large consumer following.

Optical disk technology is another niche market targeted by Sony. In 1985, the firm geared up to produce write-once optical disks. It also signed a deal that gave it licenses and patents for Energy Conversion Devices' write-once and erasable optical disks. Sony continued its moves into the telecom arena. Working with U.S.-based Compression Labs Inc., Sony developed a teleconferencing system for digital networks.

Last year roughly 8% of corporate revenues were plowed back into R&D. Unlike rivals Matsushita and Sharp, both of which are involved in Japanese artifical intelligence research consortia, Sony has opted to rely on its own R&D to develop dp technology for use in its consumer products.

RELY ON AGS.

Building an information system is a complex process. That's why AGS Management Systems has designed management and development tools to help you simplify that process. With the help of these tools you'll know what, when, and how work should be done. You'll be able to systematically prioritize, plan, organize, estimate, measure, control, and evaluate any development or maintenance project.

Our comprehensive development tools follow a methodology that lets you analyze, design and program your systems faster, with fewer errors, and throughout changing conditions and personnel. Choose the one that best suits your needs. *SDM/70*™ utilizes the traditional approach in designing and building information systems. *SDM/STRUCTURED*™ contains the most up-to-date structured analysis, design and programming techniques, including data modeling. *Computer-Aided Methodology*™ includes development and systems management guidelines, along with automated priority ranking, estimating, and project planning systems for the IBM® PC.

Each can be combined with our mainframe project management systems, PAC II® and PAC III® for total integration.

For more information about AGS' proven solutions for effective systems development, just call or write. Business, industry, government and private organizations around the world can attest to the reliability of our development tools.

FOR THE RIGHT TOOLS TO BUILD THE RIGHT INFORMATION SYSTEMS. ON TIME.

AGS Management Systems INC.

The world's leader in project management systems

880 First Avenue
King of Prussia, PA 19406
(215) 265-1550
Telex: 510-6603320

AGS Management Systems is a division of AGS Computers, Inc.

IBM is a registered trademark of International Business Machines Corporation

CIRCLE 60 ON READER CARD

If you know CAD, your opportunity window has just opened.

We're looking for the right individuals who want to control their own destiny by taking advantage of this opportunity to become financially secure. These individuals should be able to develop and maintain:

- A distribution network
- An efficient support system
- CAD training and seminars
- Client firm consulting

CADdy Corporation, a firm specializing in CAD software, knows that the future is shifting from mainframes to micro systems driven by desktop PCs. CADdy software is the result of precision German engineering written to drive over 30 personal computers. As the most popular software in Europe, it sets the standard for PC CAD software. CADdy is an easy-to-use, full-featured drafting and design package. Compared to current PC CAD leaders, CADdy offers software which is more sophisticated, performs in a wider range of CAD environments, *which results in a powerful marketing advantage.*

If you can see beyond working for a manufacturer, possess the drive to be your own boss, and have the determination to develop a working knowledge in five CAD areas–

ELECTRONIC ENGINEERING (PCB/Autorouting)
MECHANICAL ENGINEERING (Parametrics & NC Output)
ARCHITECTURAL (Design and Layout)
ELECTRICAL ENGINEERING (Ladder Schematics)
SURVEYING (Data Retrieval, Cartography, Topography)

–if you can see beyond the hardware world, call me and be there when we reach the top.

George E. Kloak

George Kloak
(312) 394-7755

CADdy Corporation, 3 Crossroads of Commerce, Rolling Meadows, IL 60008

CADdy

92

NORSK DATA AS

Olaf Helsetsvei 5
P.O. Box 25, Bogerud 0621
Oslo 6, Norway
(47-2) 295-400

Last year, Norwegian mini maker Norsk Data turned 18. As if to celebrate, it scored sales of $219.8 million (NOK1.8 billion), up 31.9% from the previous year, and moved into sleek new headquarters in the hills overlooking Oslo. Operating profits increased 56%. Norsk is currently operating on a profit margin of 16.5%, much higher than its U.S. rivals Digital Equipment Corp. and Prime.

Europe's fourth largest minicomputer manufacturer, Norsk derives more than half of its dp revenues from its home market. But outside Norway, business picked up last year in Sweden, Denmark, the U.K., and West Germany. In France, Norsk is hoping its joint venture with Matra Datasystems will open up that market. The company also got a crack at the Indian market in 1985 when the Electronics Corp. of India Ltd. (ECIL) awarded it an $11 million contract.

Entering the minicomputer market relatively late, Norsk learned from the mistakes of the mini pioneers. Early on, it carved out a niche, zeroing in on minis for scientific and technical applications. More recently, the company has branched out into the broader commercial world. Its Sintran III operating system, for example, has been designed to process both scientific and commercial applications. It also plunged into the office automation arena, giving Wang a run for its money.

93

NOKIA CORP.

P.O. Box 780
SF-00101 Helsinki, Finland
(35-8) 05671

With the midnight sun setting on parts of its 120-year-old forestry business, Nokia, Finland's largest privately owned industrial group, is turning to the sunrise, electronics sector to brighten up its revenues.

During 1985 Nokia's electronics division reflected the company's strongest growth with a 41% increase in sales, and dp revenues that jumped by 20.2% over those of 1984 to $217.6 million (FMK1.35 billion).

That boost was due to a series of lucrative international marketing agreements and to the strong performance of its dp operation, Nokia Information Systems (NIS), in Scandinavian markets. Still, Nokia had some setbacks, including a failed attempt to buy out the European network of Mohawk Data Sciences.

NIS is the largest part of the electronics division and has its own product range consisting of pcs, vdts, banking and POS terminals. It also imports and sells computers manufactured by Honeywell, Bull, DEC, and other companies. Together with IBM, Nokia dominates the Finnish marketplace, from which NIS derives about 60% of its revenues.

In data communications Nokia has a more international presence. With 90% of the Finnish market for modems as a home base, and a growing business in other European countries, Nokia concentrated on the Far East for last year's expansion. By the end of 1985 it had made modem deals in Japan, Taiwan, Singapore, Hong Kong, and China.

Nokia also is active in the components business: its Micronas subsidiary runs the only factory in Scandinavia that manufactures LSI chips.

On the oem side, the company's Salora-Luxor subsidiary produces visual displays for some of the world's top dp suppliers, including IBM and Ericsson. Nokia contends that the screens are well received because of their ergonomic design. The company is particularly proud of its so-called positive black-on-white monitors. Nokia has also maintained its oem deal with Northern Telecom in Europe for workstations to complement NT's Vienna office systems products.

The urge to expand abroad kept Nokia executives busy for most of last year, and they even came up with a new corporate strategy coining the term "multilocal," to describe the company's new approach. But multilocal is not a new idea: it simply means making products fit customers' local needs.

94
CENTRONICS DATA COMPUTER CORP.

1 Wall St.
Hudson, NH 03051
(603) 883-0111

Despite the slowdown, Centronics made a comeback in 1985. After losing $10.4 million in 1984, the company had profits for 1985 of $648,000 on a 26% sales increase to $216 million in revenues. Centronics points to its 1982 merger agreement with Computer Peripherals as the turning point in its fortunes. (Computer Peripherals, which owns 45% of Centronics, is owned jointly by Control Data, International Computers, and NCR Corp.)

Some of Centronics' success during 1985 was due to its new products, the Horizon and GLC PC-compatible printers, and the Linewriter Series 400/800. More help came from Big Blue, which bought $65 million worth of specially configured printers from Centronics. In an effort to broaden its line of products, Centronics bought the assets of Trilog Inc. of Irvine, Calif., supplier to the fast-growing CAD and CAE market.

The Centronics 1985 annual report reveals that the company has divided itself into 15 "Quality Circles" to help management. Circles aside, the top management of Centronics was beefed up during 1985, adding a vice president of quality assurance, a new vice president of engineering, and a new vice president of operations. In early 1986, Robert Stein became president and ceo, while Thomas G. Kamp remained as chairman.

95
SEAGATE TECHNOLOGY

920 Disc Drive
Scotts Valley, CA 95066
(408) 438-6550

Competition in the disk drive business stiffened in 1985, prices plummeted, and markets dwindled. Seagate Technology, one of the most successful companies in that business, saw its revenues fall by $129 million, and it reported its first operating loss in five years, $12 million.

Only an $11 million tax benefit and income from interest gave the company a net profit of $1 million on revenue of $214.6 million, 37.6% lower than last year's $343.9 million, which had produced healthy 1984 profits of $39.3 million.

Emergence of Japanese manufacturers in the disk drive market coupled with declining sales of personal computers made it tough for disk drive manufacturers to survive, let alone make a profit. For instance, both of Seagate's two biggest customers—IBM and Hewlett-Packard—have in-house disk drive manufacturing facilities. Their suppliers live in fear of sudden cancellations of orders as their big customers consider "make or buy" alternatives: the customer has become the competitor.

Seagate's dependence on IBM waned, particularly in the latter part of 1985: in the last three months of the year IBM's business represented only 28% of Seagate's revenues of $101 million, compared with nearly half in the past. The computer giant, which accounted for $175 million of Seagate's revenues in 1984, placed orders worth only $105 million in 1985.

Bowing to price pressure, the company made a 45% reduction on the sales tag of its 1984 best-seller, the ST 412, a 12MB disk drive, and then stopped making it altogether. In addition to cutting costs, the company began making more of its disk drive components in-house. It acquired Grenex Inc., a firm that makes thin-film rigid disks—a move that, incidentally, gave Seagate an attractive tax loss carryover of nearly $9 million.

Seagate stepped up its research and development costs to $19.3 million, an increase of more than $4 million. But it also found that as it responded to industry demand for higher capacity, it was pitted against new and stiffer competition, including several large Japanese firms that have moved into the market for 5¼-inch and smaller disk drives.

96
GENERAL INSTRUMENT CORP.

1775 Broadway
New York, NY 10019
(212) 207-6200

Going into 1985, things looked generally bad for General Instrument; they didn't look much better coming out. Corporate revenues of $848 million and dp revenues of $210.2 million were both down 15.4% from 1984. The company staggered under a $106.7 million loss, an astonishing 426% decrease from the year before.

But dp profitability was probably good, owing to a lively year for Sytek Inc. (51% of which is owned by GI), which doubled its revenues for the fiscal year. On the other hand, Sytek posted the big numbers thanks to its part in supplying equipment for the IBM PC Network, and GI expects those sales to be way down for the current year.

But that was it for the good news.

The Data General MV 10000-based Galaxy wagering system generated a little excitement toward the end of the year, but it soon dissipated when lottery operations in New York and California didn't buy.

Still lolling in the semiconductor and cable tv slumps, GI tried to shape itself up with a major restructuring. It took an $80 million write-off; closed a plant in Scotland and moved its entire microelectronics operation from Hicksville, N.Y., to its facility in Chandler, Ariz.; consolidated its satellite and cable television operations; sold off its interests in energy management and three quarters of its stock in Symbolics Inc.; and also sold the point-of-sale and remittance systems segments (DocuMate, CM-11, and the field service organization) of its Business Systems Division to Computer Entry Systems Corp. The idea was to focus on communications systems and computer-related products, its core businesses.

97
EASTMAN KODAK CO.

343 State St.
Rochester, NY 14650
(716) 724-2241

Eastman Kodak wrote off $494 million in 1985 after losing its patent fight with Polaroid, which drummed it out of the instant photography business. That was only one of the factors that caused the company's earnings to plunge 64% to $332 million. Revenues were up slightly at $10.63 billion, from $10.60 billion in 1984.

Verbatim, the disk manufacturer acquired by Kodak in 1984, accounts for the major portion of Kodak's data processing revenues, estimated by DATAMATION to have been $210 million in 1985.

Verbatim lost $2 million the year Kodak bought it, and the auxiliary storage market, in which Verbatim is a major player as a supplier of disk media, remained a shambles in 1985. Change was inevitable, and Verbatim, long an innovator that charged premium prices for its technology, last year tested $25.50-a-box floppy disks for the masses, to be sold through mass merchandisers like K Mart, Sears, and Montgomery Ward.

Despite new products, Verbatim revenues still fell $9 million behind the previous year. Verbatim announced a 12MB cartridge disk built specifically to match a newly invented Kodak 12MB cartridge disk drive. The company said the combination of products will offer users the high data storage capacity and reliability of rigid disk systems with the convenience and security of removable disk systems. The Kodak drive was timed at an average access rate of 75 milliseconds and internal transfer rate of 2 megabits per second.

Verbatim also unveiled a new 3½-inch erasable read/write optical disk and disk drive system that can handle 40MB of data, aimed at the computer assisted design and office automation markets.

Revenues from Atex, Kodak's supplier of computer-based editing and production equipment to newspapers and magazines, remained flat. But Kodak's acquisition of Eikonix Corp. last year with its Designmaster 8000, a digital color editing and separation system, should help Atex sales in 1986. The company combined Atex page layout systems with the Eikonix Designmaster, offering the ability to manipulate color images electronically to fit electronic page designs created on the Atex graphics display terminal.

98

GERBER SCIENTIFIC INC.

83 Gerber Rd. West
South Windsor, CT 06074
(203) 644-1551

Gerber Scientific has prospered by automating factory procedures, beginning with a vector photo plotter that sped the design of printed circuit artwork and growing into systems for computer aided design and manufacturing (CAD/CAM).

But last year was one of near disaster in capital equipment spending: the company failed to repeat its record revenues and earnings of recent years. Revenues in 1985 slipped slightly to $207.2 million from $213.2 million the year before and earnings dropped 16.5% to $19.7 million.

Gerber is organized as a collection of four subsidiaries that develop CAD/CAM products for a variety of businesses, including aerospace, footwear, automotive, apparel, electronics, construction, printing, and sign making. Hardest hit last year was Gerber Garment Technology Inc., since the strong dollar hit the American apparel industry very hard.

Gerber Scientific Products Inc., another subsidiary, makes systems to design signs. This year it added a module aimed at the Japanese and Chinese markets. It is a large memory version that stores up to 10,000 kanji symbols.

During the year, Gerber introduced a laser plotting system that converts computer aided design data from vector to raster format for imaging on film and printed circuit boards. The company also introduced a vector plotter that does both pen plotting and precision photo plotting in the production of drawings or photo plots in aerospace, automative, shipbuilding, and cartographic industries.

99

QUOTRON SYSTEMS INC.

5454 Beethoven St.
Los Angeles, CA 90066
(213) 827-4600

Quotron Systems Inc. spent the year flirting with merger offers. With a 70% share of the U.S. market in delivering computerized stock market data, it is clearly looking for ways to parlay that into a significant piece of the broader information services industry.

Quotron last year added the first international site, London, to its data communications network, which delivers up-to-the-minute prices from 63 financial markets through nearly 80,000 terminals, mostly in the offices of exchanges, banks, and brokerages. Quotron's overseas expansion is designed to meet growing competition: from British-based Reuters Holdings PLC, which dominates the business outside the U.S.; from New York-based Telerate, which is the leading provider of quotations on investments other than in the stock market, and is broadening its services; and from Princeton, N.J.-based ADP. Yet another competitor entered the ranks when ADP acquired Bunker-Ramo Information Systems from Allied Corp.

Development costs hurt Quotron's bottom line in 1985. While last year's revenues increased 8% to $205.7 million from $189.8 million in 1984, net earnings of $22 million represented an 18% decline.

Nonetheless, the company had some cause for optimism. Quotron recently formalized a promising joint agreement with AT&T, first announced last June, to develop and market an Integrated Financial Information System. IFIS will join Quotron's network and top-of-the-line computing/display system, the Q1000, with AT&T's pc workstation and StarLAN, which will connect to a customer's telephone switch.

Quotron announced last July that its largest customer, Merrill Lynch, had extended its contract to use Quotron equipment in all its offices through November 1988. That New York brokerage, which accounts for about 25% of Quotron's revenue, also took an option to use the Quotron system through November 1989.

Merrill Lynch is developing a rival stock quote system in a joint venture with no less a partner than IBM. The day after plans for the International MarketNet (IMNET) system were announced in March 1984, the price of Quotron's stock fell more than 30%; IMNET has represented a dark cloud on Quotron's horizon ever since. Analysts viewed the news that Merrill Lynch would continue with Quotron as an indication that a challenge from IMNET would not come any time soon.

100

THORN EMI PLC

Thorn EMI House
Upper Saint Martin's Lane
London WC2H 9ED, England
(44-1) 836-2444

Even though computer-related revenues were off 41% to $205 million (£159.9 million), the biggest problem for this $4.1 billion British conglomerate was semiconductor manufacturer Inmos.

During one stretch last year, Inmos losses were running at over $2 million a month. Sir Graham Wilkins, who was brought in to replace the ousted chairman Peter Laister, was so enraged by the Inmos situation that he threatened to sue the British Technology Group that had sold the IC firm to Thorn EMI.

Wilkins decided instead to fire 25% of Inmos's 2,000-strong work force, including some top execs in the U.S. subsidiary. The company's DRAM chip operations were dropped. Inmos is now promoting its reduced instruction set microprocessor, the 32-bit Transputer, announced last fall. The Transputer has sparked interest on both sides of the Atlantic, and products based on the chip are already coming to market.

Despite problems, Thorn EMI is committed to its computer and electronics operations. Earlier this year, it reorganized its Information Technology Group under ceo Tom Mayer. The new Information Systems branch includes six units: Datasolve, Software Sciences, Thorn EMI Computer Software, Micrologic, Inmos, and Thorn Ericsson, the company's joint venture with the Swedish telecom supplier.

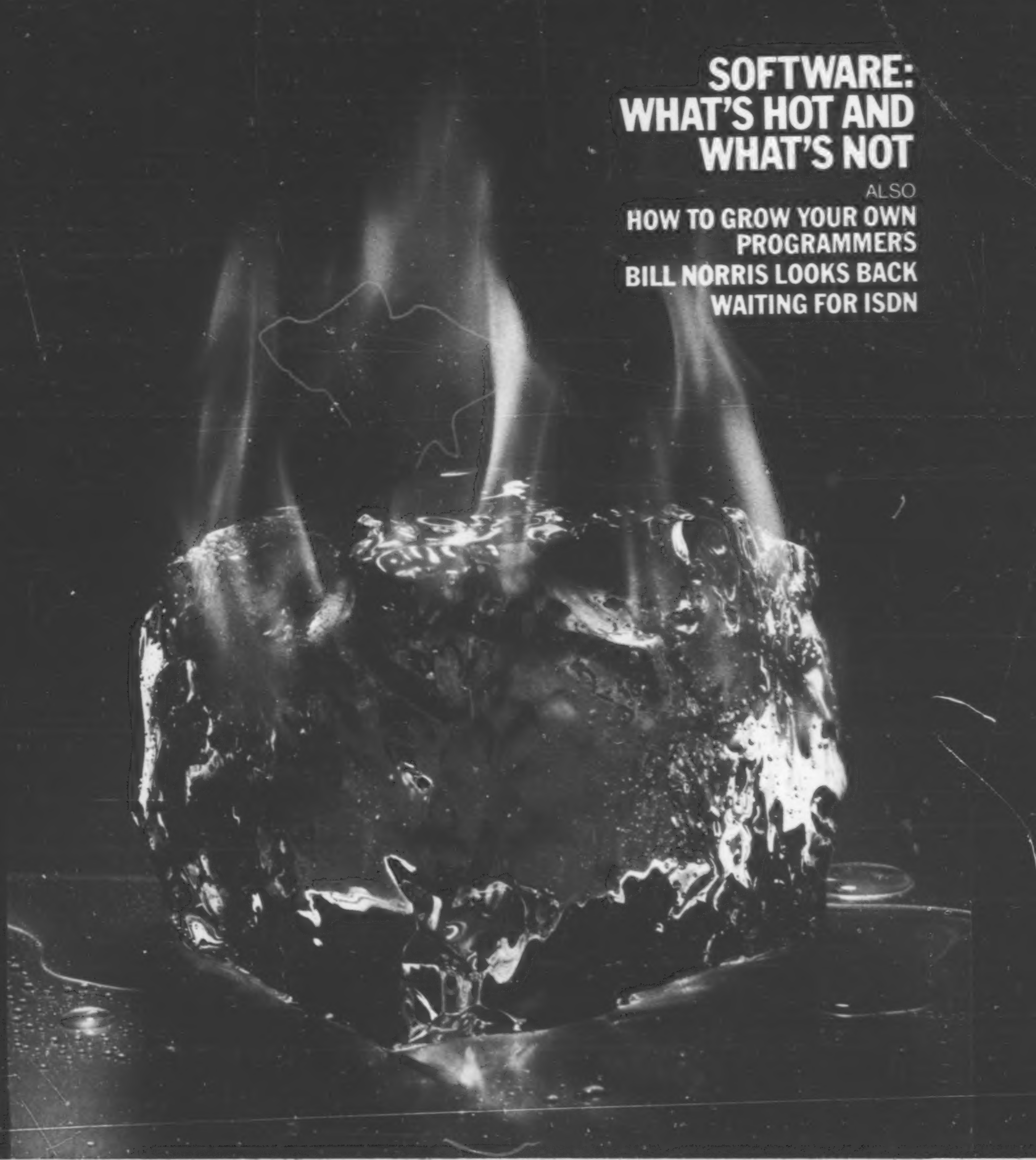
Thorn EMI's Information Technology division, which includes the company's software products and bureau and computer services, did far better than Inmos last year. Datasolve, which represents Thorn EMI's bureau interests, pulled off something of a coup when it signed up the Russian news agency Tass last year for its World Reporter news database.

Some of the company's other information technology operations haven't fared as well. At the end of last year, Thorn EMI Computer Software stopped distributing game and personal computer software in the U.K. Instead, it decided to concentrate on its own mainframe and minicomputer wares, which have been doing poorly in the U.S. market. ●

7/8/86
C8650-1A

DATAMATION

INTERNATIONAL EDITION JULY 1 $3 TECHNICAL PUBLISHING



SOFTWARE: WHAT'S HOT AND WHAT'S NOT

ALSO

HOW TO GROW YOUR OWN PROGRAMMERS

BILL NORRIS LOOKS BACK

WAITING FOR ISDN

DATAMATION

JULY 1, 1986/$3 U.S.A.
VOLUME 32 NUMBER 13
This issue, 192,901 copies

FEATURES

50
SOFTWARE: WHAT'S HOT AND WHAT'S NOT
Hesh Wiener

The patterns of program purchases are changing. Some software stalwarts are losing favor, and even the most enduring applications are being challenged.

66
THE ART OF SOFTWARE TAKEOVERS
Gail Collins

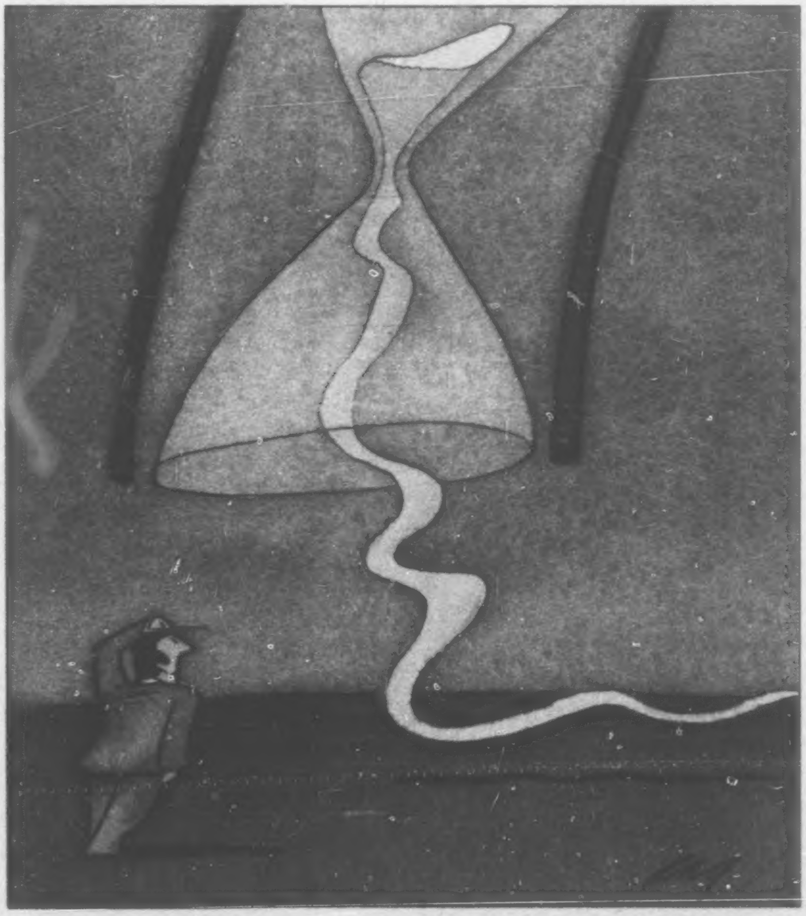
As the number of acquisitions has increased, the nature of the dealmaking has changed. Conventional wisdom is being reassessed. Can a small, entrepreneurial operation operate successfully under the wing of a large, bureaucratic company?

75
GROW YOUR OWN PROGRAMMERS
Janet Dight

It's cheaper to train new programmers than to hire experienced ones, and when you train your own, you can create the kind you need. Three organizations illustrate different approaches to in-house training.

83
WAITING FOR ISDN
Dana Blankenhorn

Major tests of ISDN-compatible switches have been delayed. Major portions of the standards underlying ISDN have yet to be agreed upon. European and American views of the final standards still differ substantially. Don't hold your breath.



NEWS IN PERSPECTIVE

18 **STANDARDS**
MAP enters the testing phase.

20 **OPERATING SYSTEMS**
Microsoft may face new tests.

26 **MINICOMPUTERS**
Prime readies new products.

30 **SOFTWARE**
Walker is off the critical list.

36 **VERTICAL APPLICATIONS**
Airlines battle for passengers.

44 **BENCHMARKS**

DEPARTMENTS

9 **LOOK AHEAD**
15 **EDITORIAL**
95 **PEOPLE**
99 **HARDWARE**
103 **SOFTWARE**
107 **READERS' FORUM**
108 **ADVERTISERS' INDEX**
108 **MARKETPLACE**

SPECIAL REPORT 92-A

(DOES NOT APPEAR IN ALL EDITIONS)

COMPUTERIZED PUBLISHING TECHNOLOGY

INTERNATIONAL 48-1

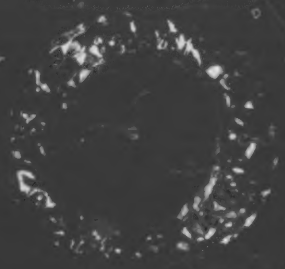
(DOES NOT APPEAR IN ALL EDITIONS)

THE INFORMATION TRADERS

COVER PHOTOGRAPH BY WALTER WICK

SOFTWARE: WHAT'S

AND WHAT'S



by Hesh Wiener

pg 50

■ When it comes to buying software, computer professionals can be as fickle as slot machines and as belligerent as toothaches. Their end users are no longer distant from the minutiae of the data processing shop. They can see the flaws along with the flourishes of computer services though the ubiquitous terminal. This has changed the focus of a computer operations department, particularly where software is concerned.

Software is now a hot medium that serves an interactive community, demanding immediate access to the organization's information resources. Batch processing, the cool medium, has faded. Though the stream of bills, checks, and reports flowing from the central data processing complex has grown ever larger, the terminal is now the focal point of computing.

With so many applications on-line, the functionality, friendliness, and resiliency of software have taken on increased importance. Across the industry, the hot sellers are programs that help the user interact with corporate data, while the packages with sluggish sales are those which do not readily accommodate the growing demands for instant data gratification.

The patterns of program purchases are changing, according to studies by market researcher Computer Intelligence Corp. of La Jolla, Calif. Some software stalwarts are losing favor, and even the most enduring applications are being challenged.

In the real world of bread-and-butter applications—payables, receivables, general ledger, and payroll—the market appears to be wide open. Surveys by Computer Intelligence show that more than 55% of the accounting software now running on IBM mainframes is homegrown, but users continue to buy packages from outside.

Purchases of accounting software seem to increase every

Momentum is difficult to establish and harder to maintain in the software business.

FIG. 1

IBM/PCM MAINFRAME SITE SOFTWARE PURCHASE PLANS

TOP 10 APPLICATION SOFTWARE AREAS

PRODUCT GROUP	PERCENT OF SITES*
Accounts payable	4
Office automation	4
Accounts receivable	3
General ledger	3
Graphics	2
Integrated manufacturing	2
Payroll	2
Personnel	2
Spreadsheet	2
Fixed asset	1

*Percent of sites interviewed during the previous six-month period that were either planning, evaluating, or had on order a product or products within the specified product group.

Source: Computer Intelligence Corp.

year. Changing tax and reporting requirements, shifting economic conditions, and the insatiable curiosity of accountants can be satisfied only by increasingly sophisticated and flexible software packages. Payables, receivables, general ledger, and payroll programs from Atlanta-based Management Sciences America—the leader in this submarket—as well as those from McCormack & Dodge, Software International, and, increasingly, Cullinet are taking business away from IBM, which once led the field and is now in second or third place. But, even MSA holds only 11% or 12% of the base, while McCormack & Dodge, Natick, Mass., boasts a 9% share. IBM has only 2% of the accounting and general ledger markets; Cullinet has about 1.5%.

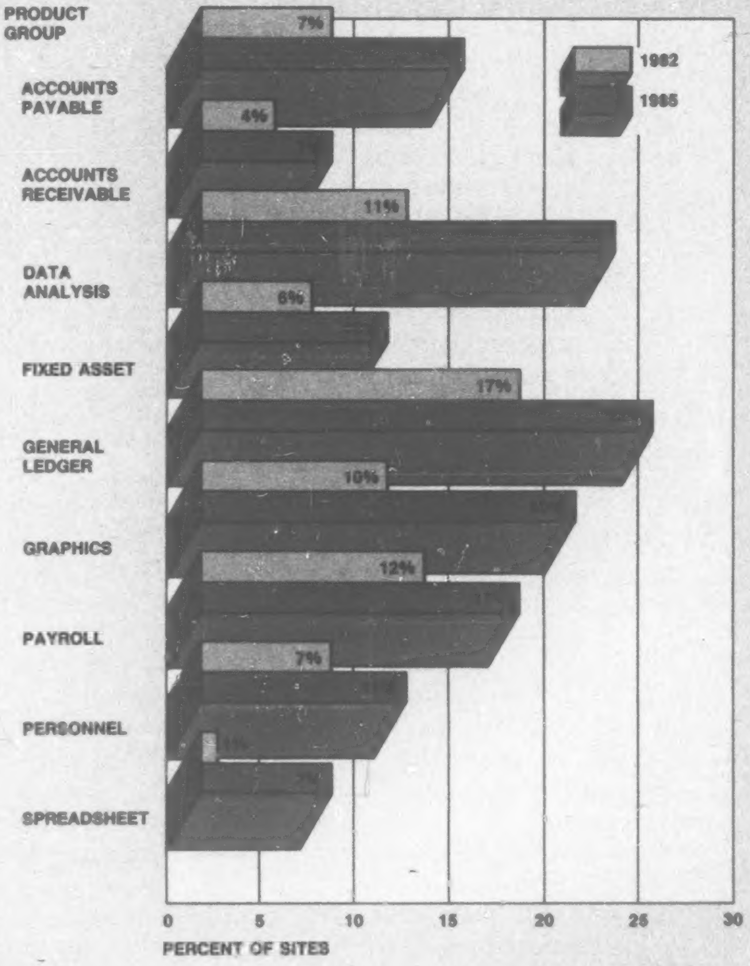
The dispersion of this market among many vendors makes it hard to cite all the products gaining or losing position in the crowd of suppliers. The very number of contenders makes for a fast race.

When Computer Intelligence asked users which applications areas they were considering for software expansion (including packages that were planned, being evaluated, and on order), accounts payable came out on top with a 4% response. Accounts receivable and general ledger each got a 3% response, and payroll was cited by 2%.

FIG. 2

APPLICATION SOFTWARE WITH COMMERCIAL PACKAGE

IBM/PCM MAINFRAME SITES



Source: Computer Intelligence Corp.

IBM mainframe sites, for the most part, already have accounting programs in place, of course. So the percentages turned up by this canvassing show that there is great mobility within the user base.

VENDORS FOLLOW IBM'S LEAD

The leading vendors in the IBM and compatible market frequently migrate their established products to other machines. This enables users of non-IBM mainframes and of most popular minicomputers to share the pool of experienced applications programmers that has grown around the leading IBM-oriented packages. In addition, some vendors—Sperry, Burroughs, and NCR, for instance—have followed IBM in offering their own basic accounting software. Others—Digital Equipment Corp. among them—actively encourage the development of program products by independents.

There are a host of office automation and electronic mail applications being implemented on multiterminal systems these days. In addition, there appears to be

FIG. 3

DBMS SOFTWARE MARKET SHARE AMONG IBM/PCM MAINFRAME SITES

SUPPLIER/ PRODUCT	YR. END—1982		YR. END—1983		YR. END—1984		YR. END—1985		MARCH 1986	
	#SITES	%SITES	#SITES	%SITES	#SITES	%SITES	#SITES	%SITES	#SITES	%SITES
ADR										
Datacom/DB	131	3	181	3	290	5	380	5	406	6
CCA										
Model 204	33	1	54	1	89	1	112	2	114	2
Cincom										
Total/TIS/Supra	438	10	494	9	534	8	546	7	547	7
Cullinet										
IDMS & IDMS/R	486	11	633	12	855	13	1,043	15	1,104	15
IBM		59		56		49		47		46
DB2	0	0	1	0	15	0	81	1	109	1
DL1	1,466	34	1,651	31	1,528	24	1,506	21	1,470	20
IMS/DB	1,018	24	1,231	23	1,415	22	1,455	20	1,458	20
SQL/DS	60	1	138	3	230	4	336	5	365	5
Info Builders										
Focus	160	4	298	6	552	9	669	9	682	9
Martin-Marietta										
RAMIS II	113	3	154	3	244	4	279	4	285	4
SAS Institute										
System 2000	82	2	102	2	114	2	114	2	113	2
Software AG										
ADABAS	241	6	332	6	418	6	451	6	456	6
Other*	61	1	88	2	158	3	219	3	228	3
TOTAL PACKAGE SITES SPECIFIED	**4,289**	**100**	**5,357**	**100**	**6,442**	**100**	**7,191**	**100**	**7,337**	**100**
Total unique sites with comm. package	3,626	40	4,379	46	5,079	50	5,483	51	5,677	52
Total unique sites in-house developed	122	1	168	2	202	2	201	2	209	2
Sites without DMBS	5,415	59	5,047	53	4,972	48	5,103	47	4,931	46
TOT. IBM/PCM SITES (CI DATAFILE)	**9,163**	**100**	**9,594**	**100**	**10,253**	**100**	**10,787**	**100**	**10,817**	**100**

*Includes: Boeing (RIM), Computer Associates (CA-Universe), D&B Computing (Nomad2), Henco (Info), IBM (Vandl), Infodata (Inquire), (IQ/Net), Nixdorf (NCSC/DB), Oracle (Oracle), Seed (Seed), Sir (Sir/DBMS)

Source: Computer Intelligence Corp.

a real need for text retrieval systems that can work on networks. The linkage of office support programs with IBM's DISOSS (for MVS systems) and PROFS (for machines running VM) appears to be only a beginning, and not necessarily an auspicious one.

Even among the bluest of IBM mainframe users, DEC has attracted office automation users with its All-In-1 product; other mini makers, including Data General, provide versatile packages. Some of the non-IBM systems seem to be easier to integrate with SNA and IBM's other solutions.

In addition to applications ultimately hosted by mainframes, manufacturers of midrange systems, well-armed with user-efficient software, have successfully gone after standalone or turnkey applications. The mini makers appear to have targeted the markets once largely controlled by IBM with its System/34 and 36, and, more important, Wang Labs with its several versatile small computers. Independent software packages for office automation have not yet made much of a dent in this market.

CAD/CAM, MRP, and other applications areas geared to manufacturing companies will continue to grow in importance. IBM has backed CADAM for its automated design users, while DEC's base seems to be dispersed among the offerings of several independents led by Intergraph and McAuto. The MRP software race won't be decided any time soon. CIM applications are just starting to hit the street, their vendors hoping that GM's MAP protocol standard will increase user interest.

Some market battles have been raging for years. The most hotly contested large-system DBMS market is that for IBM mainframes. More than a dozen significant vendors offer products for the big IBM boxes. Market shares can change substantially in a relatively short time, not so much because users abandon established systems, but because new applications require the use of newer software. One of the big changes in the market has been the growing acceptance of relational DBMS programs and the consequent reduction of user interest in older hierarchical packages.

The decline in IBM's share of the DBMS market reflects the new popularity of relational DBMS programs. IBM seems to have pegged its hopes for the DBMS business to relational DB2, a late bloomer but nevertheless a program that many users have to

Artificial intelligence software could well be the key to applications generation.

THE PC PACKAGE MERRY-GO-ROUND

Professional artist and semipro nightclub character Andy Warhol is said to have described the modern era as a time when everybody will be famous for 15 minutes. He might have had a vision of the pc software business, where nearly all the vendors have had, at most, one successful product. Even Lotus, the richest of the software industry's micro moguls, with both of its big successes in the satin spreadsheet arena, is still playing a one-hitter. Microsoft and a few others are the exceptions—fluorescents to the industry's many flashbulbs.

In March, Curt Monash, the software industry analyst at Paine Webber, assembled a panel of experts to review the state of the program product trade. Monash's report on the gathering emphasized that "many panelists believe that the proliferation of pcs represents a significant shift in the balance of power from data processing departments to users, with the result of end users getting more involved with software purchasing decisions."

If this observation is correct, dp departments will have to stay on top of pc program trends in order to maintain companywide standards. This may prove difficult, as there are dozens and dozens of micro software companies, each with one or more products. Many, if not most, of these programs were written with the business user in mind. Fortunately for the computer professional, the current leaders in the most important submarkets are relatively easy to spot.

If it's a spreadsheet, for instance, there's nothing that can touch 1-2-3, any more than another micro software house could match Lotus's $225 million-plus annual revenue. Estimates of the Lotus market share vary, but they hover around 65% of the corporate pc user market, a figure that must sorely tempt Microsoft. Some observers say that Microsoft's Excel isn't really aimed at 1-2-3, but at Symphony, a 1-2-3 cousin that Lotus positions as a distinct product. For the corporate user, Symphony may not be an issue; Lotus still hasn't upgraded most 1-2-3 version 1A users to 2.0, let alone gotten them to learn to use an even more complicated tool kit.

If it's communications software, the leader is probably Microstuf's Crosstalk, but data in this market are not consistent. A Tallahassee, Fla., upstart, Softklone, has started horning in on Crosstalk's customers with its Mirror product. Modem magnate Hayes has done well with Smartcomm. And Microsoft (again!) is hoping to make a dent with its Access program. Most pundits agree that the micro DBMS market is a lot simpler to follow than other sectors. They all say that Ashton-Tate, with its dBase II and III lines, is numero uno, while second place is held by Microrim with its Rbase series. But after that, it's anyone's guess.

Word processing may turn out to be IBM's game. Now that the Displaywriter is dead, PCs are frequently haunted by its ghost, the Displaywrite program. Multimate's software, a micro takeoff on Wang's word processing, is probably number two after IBM's product.

But there's change in the wind, caused, in large measure, by the growing popularity of laser printers, principally those from Hewlett-Packard and Apple. Getting the most out of laser printers means handling proportional typefaces and elementary type composition such as multicolumn layouts. Word Perfect Corp.'s offering and Microsoft Word are said to be the favorites of the micro press lords.

With all the hubbub about relatively new products, it is easy to ignore MicroPro's WordStar, which led the market for years and is still very important. For the past couple of years, WordStar has been influential more by virtue of its installed base than because of its growth. Lately, it has undergone extensive renovation in a renewed bid for leadership.

Other hot sellers are the little programs that save time. For the memorandum writers, there are spelling checkers (increasingly included in high-end word processors), the most popular of which is probably The Word from Oasis Systems, and the most powerful of which is probably V-Spell from Compuview.

There are also the packages nobody talks openly about, used to make extra backups of ostensibly copy-protected software, programs like Copy II PC. These dandies are the perfect adjunct to a vintage IBM PC AT, the one with the hard (to trust) disk.

—H.W.

---

take seriously. The installed base of IBM's mainframe DBMS packages has risen since the end of 1982 to 3,400 from 2,500, a 36% gain, according to detailed surveys conducted by Computer Intelligence. During the same period, however, the total population of DBMS packages on IBM and compatible mainframes soared 71%, from nearly 4,300 installed program products to more than 7,300. IBM's share of the base has fallen from 59% to 46%. Some observers, such as Curt Monash, analyst at the brokerage firm of Paine Webber Inc., New York, believe IBM's share of DBMS sales may have fallen to as low as 20% of new installations in 1984, before the company began to get DB2 and other relational offerings out the door.

DL/1 is the most popular package for the IBM mainframe shop by number of installations. In fact, 43% of its DBMS user base consists of DL/1 sites, machines running DOS family operating systems. The total installed base of DL/1 has been falling since 1983, and now numbers approximately 1,470 sites, down 11% from a high of 1,651, according to Computer Intelligence. DL/1's loss of market share has been even more dramatic. In 1982, DL/1 accounted for 34% of the IBM and compatible mainframe DBMS packages installed in the U.S. Today it garners only 20% of the market.

The strongest non-IBM products in the DOS environment, Cincom's Total/TIS/Supra family, are also losing market share. They now hold a 7% slice, down from 10% of the relevant market. Unlike DL/1, however, Cincom's base is still growing in absolute numbers.

The wealthiest IBM customers with large databases and more powerful systems to support under the MVS/XA and VM operating systems have increasingly been going to independents for software. IBM's large system DBMS leader, IMS, still has the largest acceptance in the market, but the gap is being closed. IBM not only has lost its former majority position in this lucrative sector, but could conceivably lose its leadership as well.

In 1982, IBM had, with 1,018 users, 24% penetration of the relevant market. By March of this year, that slice had dwindled to 20%, although the number of installations had risen to 1,458.

This trend will continue, since users generally are not looking for more flexible software for new applications. Users will maintain their IMS applications and will occasionally add new ones, putting IMS on a relative handful of systems. (The base grew by only 43 sites between December 1984 and March 1986.)

The obsolescence of IMS has come about through IBM's own research into database systems, and the company's introduction of relational successors, such as DB2, first shipped in volume last year. DB2's base is only now getting big enough

The user bases for non-IBM mainframes are considerably smaller than that for the IBM boxes.

FIG. 4 -

PC SOFTWARE PLANS TO PURCHASE

MOST FREQUENTLY MENTIONED AREAS

PRODUCT GROUP	PERCENT OF SITES PLAN, EVALUATE, ON-ORDER
CAD/CAM	8
Graphics	7
Project management	7
DBMS	4
Office Automation	3
Micro/mainframe (Host)	3
Financial modeling	2
Micro/mainframe (PC)	2
Spreadsheet	1

Source: Computer Intelligence Corp.

to make it a mainstream product; Computer Intelligence has identified only about 150 installations of the package. Analyst Curt Monash suggests the slow takeoff of DB2 should not be misinterpreted by users; he believes that IBM has a strong product here, one that could gobble up more than half the market.

Cullinet, with its IDMS and IDMS/R, is IBM's most serious contender in the large mainframe DBMS market. IDMS/R, a relational product, still accounts for only about 10% to 15% of the IDMS base, although it is of increasing importance. The IDMS product line now holds a 15% market share with 1,104 installations, the result of steady growth from its year-end 1982 share of 11%, or 486 sites. Others are also making inroads into this increasingly competitive market. Focus, from Information Builders, for example, could be a rising star, with 682 installations, or 9% of the market.

The IBM and compatible mainframe DBMS market has lots of room to grow. The 5,677 sites with commercial DBMS packages and 209 sites with homegrown programs identified by Computer Intelligence in its software study comprise only 54% of 10,817 IBM and compatible mainframe sites surveyed. The remainder of the base reports that no major DBMS is currently installed. Once a DBMS proves out, however, others may be brought in. The 5,677 DBMS users surveyed have installed 7,337 packages, or about 1.3 per site. That means the market potential of DBMS could be larger by numbers than that for mainframes, particularly if some DBMS grew to become a strategic adjunct to the operating system.

Beyond the IBM mainframe world, the DBMS market is sometimes a captive one. Burroughs mainframe users almost universally run their hardware suppliers' DMSII software. At Sperry the picture is similar. Users of Sperry's 1100 series mainframes overwhelmingly prefer Sperry DBMS software to that supplied by independents; research data show that 88% of Sperry's users' DBMS systems come from the vendor. Most of the rest use versions of System 2000, from SAS Institute, Raleigh, N.C.

NCR and Honeywell mainframe users, by contrast, depend on versions of Cincom's Total more than any other DBMS package; here the computer maker has cooperated, rather than competed, with the software industry. By forging special relationships with Cincom, the mainframers have avoided the costs and risks of developing their own DBMS packages, while Cincom has been assured of a profitable and captive user base. The user gains too, because the pool of Total programmers is far larger than that which would form around an NCR- or Honeywell-specific package.

The most dramatic battle for DBMS market share is shaping up in the VAX base. According to Computer Intelligence, which puts special emphasis on tracking Digital Equipment, DEC's own software offerings—DEC DBMS, Datatrieve, and RDB—together account for more than 68% of the total installed base. Digital's present market dominance notwithstanding, the score of contenders for market share promises to be a source of change. The present success of DEC's superminis—which overlap IBM's

A DIFFERENT VIEWPOINT

Another perspective on users' spending for applications software can be found in the DATAMATION/Cowen & Co. 1986 Computer/Telecommunications Industry Survey, tabulated early this year (see "1986 Mainframe Survey," May 1, p. 67). Some 2,600 qualified responses from IBM and compatible mainframe sites show continuing changes in how applications are being built.

The survey found that approximately 61% of users' spending for unbundled mainframe software goes for systems packages and 39% for applications packages.

Asked what percentage of their organizations' annual dp budgets goes for unbundled software (applications and systems packages) from IBM and other suppliers, users indicated that IBM gets 61% of their total software spending. This figure continues a downward trend that began in the 1982 survey, when the comparable figure peaked at 67%.

In 1982, 55% of the respondents said that spending on in-house staff was the fastest growing portion of their applications software budget. That percentage has now declined to 47% in the dp shops surveyed. An equal percentage of the respondents are increasing expenditures on packaged software more than anything else in their budgets for applications software.

For the second year in a row, a decline was detected in the backlog of applications waiting to be implemented by these mainframe sites. Asked how many months would be needed for present staff to implement all currently planned applications, 24% of the respondents said less than 12 months. In last year's survey, the comparable figure was 22%, up from 18% the year before. The number indicating that their backlog stretched more than 24 months into the future has declined to 34% this year from 45% in 1982.

The longstanding trend of increasing use of packaged software is flattening out, according to the survey. In 1985's survey, half of the users said they would use prepackaged code; only 47% said so this year. This seems to signal a reversal of a trend that began in 1982, when only 38% of respondents went for packaged software. Packaged software was found to eat up 10% of the average dp budget at these mainframe sites.

Users were also asked about their use of packaged personal computer software. The packages most used were, in order, Lotus 1-2-3, IBM Displaywriter, Ashton-Tate's dBase, and Micropro's Wordstar. Among the packages showing the fastest expansion among this sample of mainframe users were IBM's Topview and Displaywrite, with imputed population growth rates of 14% and 6%, respectively. On the whole, however, just as the corporate pc hardware market is showing signs of saturation, so is pc software. For instance, about 73% of the responding sites had 1-2-3 installed at the time of the survey, but only 3.5% of the sites planned to acquire additional copies. Initial acquisitions of the spreadsheet package were contemplated in only 6.4% of the sites during 1986-87.

—John W. Verity

IBM may have the last word in the remote terminal market, but it has not yet spoken coherently.

smaller mainframes in performance—adds to the frenzy.

Ingres, sold by Relational Technology Inc. of Alameda, Calif., with 8% of the VAX and MicroVAX base, is ahead of DEC's RDB package (with its 5% share) and nearly as popular as DEC's DBMS (9.5% share). Third in line is the eponymous program product from Oracle, Menlo Park, Calif. (5% share). Intergraph's DMRS and Bolt, Beranek and Newman's RS/1 are tied behind Oracle. More than two dozen other offerings, only a few of them now significant, follow these leaders into the fray.

While only the leading independent packages currently enjoy nutritional slices of the market, the vast size of the base alone is enough to engender significant competition. Various industry estimates put the North American VAX census at 16,000 to 20,000 systems, and growing.

Digital has enlarged its hardware base rapidly of late. Numerous systems are used in CIM applications where a DBMS is important, if not vital. Industrial networks, transaction-oriented business systems, and CAD hosting applications all beckon databases, particularly relational ones that can more easily handle unanticipated aggregations of data.

Interest in DBMS software among DEC users is relatively recent, particularly in comparison to DBMS usage among IBM mainframe users. This means that software houses won't have to face the customer resistance that is typically associated with database conversions. In the end, VAX systems, by virtue of their late arrival on the DBMS scene, may well boast the most interesting and powerful database programs in the industry.

Graphics programs are also hot, and the market is teeming with contestants. The leader by a nose in the IBM mainframe environment is the creator of SAS/Graph, SAS Institute, which supplied more than 43% of the 2,600 presentation graphics packages turned up in Computer Intelligence surveys. IBM's own GDDM ran second, with 41.5% of the base, while products from San Diego-based Issco, together representing more than 13% of all graphics packages cited by respondents, were a distant third.

One of the problems users have with graphics packages is the dispersion of data and resultant images across networks. IBM's programs work in all-IBM networks, but don't run on DEC or other non-IBM minicomputers. Nor does IBM's software adequately support plain IBM PCs or compatibles. The upshot may be a movement toward independents in general, and toward SAS Institute and Issco in particular. Both these companies are trying to keep their graphics software offerings as machine independent as possible by offering user-compatible and data-compatible versions for many operating environments.

Among DEC VAX users, DEC, with a nearly 24% market share, is the top graphics software provider, but Issco, with a 19% market share, is the most significant independent. SAS, the leading independent in the IBM market, has a smaller market share in the VAX world, less than 10%. ◉

Hesh Wiener is president of Technology News of America, a New York City publishing company. He is a contributing editor of DATAMATION.

ADVERTISING OFFICES

Francie Bolger,
Eastern Regional Sales Manager
Eastern District Managers:
John M. Gleason, Kathleen A. Murray
New York, NY 10022
875 Third Ave.
(212) 605-9400
Plymouth Meeting, PA 19462
Plymouth Plaza, Suite 201
(215) 825-4410

New England District Managers:
Ed Rappaport, Michael W. Andrea
Newton, MA 02159
199 Wells Ave.
(617) 964-3730

Southern District Manager:
Scott Schumacker
Atlanta, GA 30329
4 Executive Park Drive N.E., Suite 1205
(404) 633-5112

Midwest District Manager:
Joseph P. Gleason
Flossmoor, IL 60422
PO Box 279
(312) 381-1840

James E. Filiatrault,
Western Regional Sales Manager
Western District Managers:
Janet Engelbrecht
Mountain View, CA 94043
2680 Bayshore Frontage Rd., Suite 401
(415) 965-8222

Robert J. Rielly
Los Angeles, CA 90035
1801 S. LaCienega Blvd.
(213) 559-5111

William M. Wilshire
Irvine, CA 92715
2061 Business Center Dr., Suite 111
(714) 476-2511

Southwest District Manager
Thomas C. Rousseau
Dallas, Texas 75243
9330 LBJ Freeway, Suite 1060
(214) 644-3683

Postcard Inquiry Service/Recruitment/
Marketplace:
Shirley Stirling
(212) 605-9733
Toll Free (Outside N.Y.) (800) 223-0743

Technical Publishing
DB a company of
The Dun & Bradstreet Corporation

John K. Abely, President
Robert L. Dickson, Exec. Vice President
Edwin V. Burkholder, Senior Vice President/Technology
Walter M. Harrington, Vice President/Finance and Administration

Sal Massimino,
Managing Director, Europe
U.K., Scandinavia, Netherlands, France, Belgium, Luxembourg, Spain, Italy, Switzerland (Fr):
Martin Sutcliffe
Technical Publishing Co.
27 Paul Street, London, EC2A 4JU, England
Tel: (44 1) 628-7030, Telex: 914911 TECPUB G

Germany, Austria, E. Europe, Switzerland (Ger):
Martin Noble
Technical Publishing Co.
6000 Frankfurt 1
Steinweg 7, W. Germany
Tel: (49 69) 28-80-63, Telex: 4170039 TECP D

Japan:
Hiroshi Sato
IRM, Inc.
Bosei Building, 4-2,
Higashi Azabu 1-Chome,
Minato-Ku, Tokyo 106, Japan
Tel: (03) 584-1241, Telex: 242-2588 IRMTOK J

Israel:
Roseline Lewin-Wainberg
68 Sokolov St.
Ramat Hasharon 47 235, Israel
Tel: 03-49 12 69

The pace of software acquisition activity has become increasingly frantic.

THE ART OF SOFTWARE TAKEOVERS

by Gail Collins

William Goodhew, president of Peachtree Software, likes to compare the software business to crabgrass. That's right, crabgrass. Since it doesn't cost much to enter the business, just about anyone with an idea and a kitchen table can start a software company. While many startups are eventually taken over, new ones keep popping up. Says Goodhew, "It's just like crabgrass: I may pull a whole lot out, but a whole lot more is going to grow right back in overnight."

Acquisitions have been standard fare in the software industry since its earliest days. Recently, however, the pace of activity has become increasingly frantic. The ADAPSO/Broadview index of mergers and acquisitions of software and computer services companies listed 203 deals worth $2.5 billion last year, up from 87 deals worth $1.4 billion five years earlier.

As the number of deals has increased, the nature of the deal-making has changed. The conventional wisdom that the value of a software company rests mainly in the creativity of its people is being reassessed, and the ultimate success of some acquisitions is coming under scrutiny. Some question whether a small, entrepreneurial operation can operate successfully under the wing of a large, bureaucratic company.

To many industry observers, however, all this acquisition activity is nothing but good. It's made possible by the wellspring of software startups, which, according to ADAPSO head Jerome Dryer, "is a strength of the industry." Adds George Grodahl, a partner of Broadview Associates, "We're constantly amazed by the companies we trip across making $7 million to $10 million that we've never heard of before."

One reason behind all this acquisition activity is that small companies often lack the resources necessary to fund their growth. "The barriers to entry are pretty low," says Grodahl. "If I have an in-depth knowledge of the industry application area, I can develop a package. I may even know the area well enough to know exactly where to go to make the initial sale. I can do all that on a shoestring.

"I can bootstrap myself up through obvious phases of development. But I get to a point where I need that marketing capability.

This is the positive side of mergers and acquisitions—providing a little guy with the cash, the expertise, and the helping hand necessary to break into the big time. Software customers are also beneficiaries since they can rest assured knowing that the company that produced their software is part of a substantial organization and is not likely to close up shop and vanish overnight.

NEGATIVE SIDE OF MERGERS

But some companies don't want to be bought. Fearing they'll be a target and figuring a good offense is the best defense, they may join the fray. The result? Deals for deals' sakes, bad matches, inappropriate management, and an unstable environment that does not nurture product development.

Already, the frenzied buying activity has begun to erode the old notion that a takeover has to proceed gently lest the real value of the business decides to walk out the door once the purchase is completed. Talk of "neutron bomb acquisitions" in which only the property is left standing may be hyperbole, but, as Peachtree's Goodhew notes, "it's pretty extreme vocabulary for a business where everybody used to go into an acquisition talking about 'empathy.' "

The hostility shown last year in the deal struck between Dallas-based Sterling Software and Informatics, Woodland Hills, Calif., is cited as an example of the new realities of software acquisitions. Informatics chairman Walter C. Bauer lost a fight for control of his company. After trying to make a management buyout, he was rebuffed by his board of directors in favor of Sterling Software's higher bid.

Bauer acknowledges the new trend. Now chairman and chief executive of Delphi Systems, he says, "Gradually, people in the industry are recognizing there are intrinsic values to an organization: proprietary software, business know-how of a proprietary nature, and good will." (Ironically, Bauer demurs on the amount of hostility involved in the Informatics takeover. The ultimate in unfriendliness, he claims, "is when you tender for stock. Nobody's done that yet.")

Like an acquisition in virtually any industry, Sterling was after Informatics' assets, and willing to pay the price. Sterling "knew there was underlying value—some of the businesses could be managed better, some could be spun off, costs could be trimmed," says Broadview's Grodahl.

Charles Frumberg, a computer industry analyst at Mabon Nugent & Co., a New York brokerage firm, agrees: "A large part of the play was [Informatics'] balance sheet."

The fact that Sterling's stock soared after the deal may encourage more aggressive takeover practices in the future. "People were overemphasizing the idea that you couldn't do a hostile takeover," says William Miller, an analyst at Legg Mason, a Cleveland-based brokerage firm. Miller adds, however, "You can't be indifferent to the people. It depends on what you're trying to buy." Future acquirers, he says, will still have to be careful they don't drop a neutron bomb by mistake: "You don't want to pay for people and get only products."

Despite the Sterling-Informatics fight, many in the mainframe software business are still wary of dragging their acquisitions to the altar. Jericho, N.Y.-based Computer Associates, for example, an active shopper in the merger market whose name has occasionally been linked to the neutron bomb approach, says it still subscribes to the buy-the-people doctrine. "In every one of our acquisitions we've let people go—those who were duplications of people we already had," says David Tory,

ILLUSTRATION BY DANIEL MAFFIA

FIG. 1

THE TOP SOFTWARE DEALS OF 1985

Ameritech buys ADR	$215 million
Sterling Software buys Informatics General	$126 million
Lockheed buys Metier Management Systems	$125 million
Information Resources Inc. buys Management Decisions Inc.	$38.5 million
Systems Designers Intl. (U.K. based) buys Warrington Associates	$26 million
Computer Associates Intl. buys Top Secret product from CGA	$25 million
Ashton-Tate buys Multimate Intl.	$22 million
Data I/O buys Futurenet	$20 million
Hewlett-Packard buys Caricor Inc.	not disclosed
Equitable Life Assurance buys Advanced Systems Applications	not disclosed

Source: Broadview Associates, Fort Lee, N.J.

vice president, planning. "But in every case the core, main technology we were acquiring was in the people. We're not interested in property—we're interested in people."

John Imlay, ceo at Management Sciences America (MSA), Atlanta, agrees. He believes that the emphasis has to be on people because the business "requires a great deal of service and people-knowledge. What you're buying is people's talents."

It's natural for MSA to make acquisitions, he explains, because "we buy products to fulfill different needs of the same customer." When MSA needs a product, Imlay says, "we normally would buy the whole company—you get sales, service, customers, crews, development people."

To illustrate MSA's approach, Imlay points to the decision made in the early '80s to sell a complete line of software for the company's manufacturing clients.

To carry out this idea, MSA first bought manufacturing software producer Arista, Winston-Salem, N.C., from Xerox in 1981. Then, in 1983, MSA bought Computeristics, a Hamden, Conn., firm that created software for order processing.

Both Arista and Computeristics now have their administrative functions performed by MSA but "all the development people have been kept intact," Imlay says, and still work in their old home bases. The turnover among development people has been less than 12% since the acquisitions, Imlay estimates.

As long as MSA stuck to the business it knew best, its acquisition strategy worked. But MSA became a little careless when it bought Atlanta-based Peachtree Software in 1981—an error that cost both companies dearly.

IT SEEMED TO BE A FIT

MSA entered the agreement mistakenly assuming that selling software for micros would be the same as selling it for mainframes. But as time passed, it became clear that Peachtree's product had to be sold like the rest of micro software—through traditional retail distribution channels.

The much-touted fit between the two companies became less comfortable. "Even though MSA sold accounting systems and Peachtree sold accounting systems—it was sort of like one guy sold blue ballpoint pens and one guy sold blue cars," says Goodhew.

Worse, Peachtree had fallen into the same trap MSA had. Seeking that ever elusive synergy, it had acquired two educational software companies in 1983, Eduware and Designware. The idea behind the acquisitions was to use the strength of the Peachtree name to market the two smaller companies' products. But the result, Goodhew explains, was like the famous story of Life Saver chewing gum. The name might be well-known, but it just didn't connect with the product.

MSA sold Eduware and Designware to Encyclopaedia Britannica and Peachtree to Intelligent Systems, a Norcross, Ga., holding company that owns a number of micro-related businesses. The prices were not disclosed, but MSA did take a $13 million loss on the micro debacle in 1985.

Goodhew used to believe that Peachtree could not afford to have all its eggs in the accounting basket. But now his philosophy is the opposite: "Put all your eggs in one basket, and then take *very* good care of that basket," he declares.

Acquisitions and divestitures have become a corporate life-style at many companies. Dallas-based Uccel, for instance, bought six companies on the Broadview list in 1985. "We've been more active than we thought," said Peter Barris, director of acquisitions, when the list was read to him.

Uccel, Barris says, is taking itself apart and rebuilding in a new image. On Jan. 1, Uccel sold its mainframe accounting business to Global Software for an undisclosed price. That business, Barris says, did not mesh with its new strategy of sticking to mainframe banking application software. At the same time, however, Uccel spent $3 million to buy ISA, maker of the micro accounting program Harmony. Barris says the deal was a "product acquisition." Harmony was given to Uccel's micro software company, Open Systems, and ISA was dissolved.

OUTSIDERS NOW BIG BUYERS

The emergence of "outsiders" as big buyers of software firms is another trend that has emerged as the pace of acquisitions has increased. The 1985 ADAPSO/Broadview Index showed a record 23 companies outside the industry making their first acquisition in the software industry. "The most significant new category of acquirers was Bell operating companies," says Grodahl.

The $215 million acquisition of Applied Data Research by Ameritech is probably the most widely discussed deal in this category. Besides Ameritech and ADR, Grodahl points to Continental Telecom's $32 million turnkey purchase of Northern Data Systems and NYNEX's purchase of Data Group for an undisclosed price.

But even more notable, perhaps, are the wealth and diversity of smaller acquisitions by noncomputer firms. Banks and insurance companies have been among the biggest players. Philadelphia-based Cigna, a major insurance company, has been one of the year's busiest shoppers, buying four firms, including Dyer, Wells & Associates, Atlanta, a maker of human resource software.

Legg Mason's William Miller thinks the outsider theory has been oversold. The bulk of the companies doing the buying "are not really noncomputer companies. I'd be surprised if McDonald's enters the market, but a GM, an Ameritech—the fit isn't bad. There's obviously a need for computer sophistication across a wide variety of companies."

Indeed, most of the new corporate acquirers are already major software users who understand their way around a computer. But their corporate cultures are very different, and the problems of adjustment are not mitigated by the fact that all sides can use a similar technical vocabulary.

The noncomputer companies' motives for the purchases are varied. Some of the deals appear to be mere product acquisitions, and some pure investments. But most corporate buyers claim to be on a quest for the Holy Grail of synergy—a fit of needs and resources that make both acquirer and acquiree stronger together than they were apart.

Cigna, for instance, needed software to organize flexible benefits packages, the popular new wrinkle in employee benefits

Can a small, entrepreneurial operation operate successfully under the wing of a large, bureaucratic company?

programs that allows a firm's employees to choose from a "cafeteria" of health programs and other benefits. The insurance company's own product was manually organized and unsophisticated. To stay competitive, Cigna felt it needed to offer a more comprehensive plan that could provide a dozen or more benefit options, payroll deductions, yearly reenrollment, and the ability to trade in vacation days for cash.

The question was whether to develop the software in-house, or purchase a company like Dyer, Wells, whose product, now named Flextrax, offered the organizational components Cigna was seeking. Travers Wills, senior vice president of Cigna Systems, argued for the buy-the-company strategy. "We got the software for a fifth of what it would have cost to do it ourselves," he says. "We also cut the development time to about a third. We got tremendous leverage."

EVERYONE LOOKS FOR SYNERGY

In addition, Wills says, the two companies should be able to complement each others' marketing efforts. If Cigna's customers decide they eventually want to administer their own flexible benefit program, "we can say okay, we have a company that sells a system identical to the one we use. We guarantee you'll need no conversion." Dyer, Wells, he says, can recommend Cigna to some of its clients. "This is called synergy. It's what all companies are looking for," Wills says.

The plan for Dyer, Wells also includes expectations that the software firm will eventually help market software Cigna develops internally, or develop software that the insurance company's overburdened in-house programmers don't have time to produce. Neither goal has been attempted yet, Wills says. But, he claims, the flexible benefits software Cigna got was itself worth the $6.8 million it paid for Dyer, Wells.

The Chicago-based Bell operating company Ameritech, maker of the deal-of-the-year, is far less specific about its ideas for ADR. Reporters probing for details "come away frustrated," admits a spokesman at Ameritech's public relations division. "It's fair to say there are a hell of a lot more questions than answers."

Ameritech executives say they wanted a computer connection because communications and computerization are becoming more and more interwined. ADR was attractive, they say, because it's a premier company in systems software.

"With applications software, all we'd bring to the merger is money," says Robert Prothero, vice president for information systems technology at Ameritech. "In systems software we do have expertise." Prothero admits, however, that Ameritech has not yet figured out where the ever-popular synergy will come from. In contrast, NYNEX, the New York-based Bell operating company, began shopping for software firms earlier than Ameritech. It says it wants to be a "a significant player in applications software systems integration—a very significant player." This year NYNEX Development Co. purchased Telco, maker of telecom management systems, for an undisclosed price. Last year it bought Data Group, creator of Field Watch, software used in customer service/field service for minis, micros, and mainframes.

"We'll be buying others," promises Gar Selig, vice president for development at NYNEX. The new acquisitions are not intended as suppliers of internal NYNEX needs, and will be operated in a hands-off management style, he says.

"Hands-off" is second in popularity only to "synergy" in the vocabulary of corporate executives who acquire software businesses for the parent company. It's the code word for avoiding all the problems that come when a big, mature, conservative company buys a smaller software business that counts flexibility and creativity as its strengths.

Observers wonder how many small software firms will be able to avoid being smothered by a large bureaucratic overseer, no matter where it promises to keep its hands. "Cigna . . . wonders about that," laughs Travers Wills, who is a little atypical because he admits that it's problematic when a giant corporation becomes parent to a growing young software firm. "It's very difficult. I don't think cultures will ever be the same. The benefit [of Dyer, Wells] is its spontaneity, flexibility. You don't work for a software company if you're risk-adverse."

A self-described "corporate creature," Wills says he finds it difficult to relate to Dyer, Wells's "lack of process. They're inclined to jump in and try things." Lately, for example, Dyer, Wells has been lobbying for permission to branch off into a new venture, as yet undisclosed. Even though Wills thinks the idea is a good one, the two sides are finding it difficult to arrive at a decision together. "I'm very excited about [the new venture], too, but when I poke at it, they give me no reasons," Wills says. "They're very frustrated at my prodding and I'm very frustrated by their lack of follow-through."

Wills volunteers that Cigna made a mistake early on in trying to manage too closely. That posed an immediate image problem for Dyer, Wells, which had other insurance company clients for Flextrax. For instance, Travelers is a Dyer, Wells client, Wills says. Any indication that Cigna had a privileged relationship could have been fatal to Dyer, Wells's marketing efforts, Wills says. "I don't know how they'd sell against that." Now, he claims, the company has backed off.

"When I started, I thought I'd run this firm closer to Cigna. But now we have a true arm's-length relationship," he says. Cigna now pays the going rate for services from Dyer, Wells and the two companies sometimes compete for the same jobs. "For the purposes of management," says Wills, "I'm the only contact between the two companies."

At NYNEX, Selig claims there have been no problems at all between the corporate cultures. "We know what we're doing," he states.

Alan Atkinson, president and ceo at Data Group, Burlington, Mass., says he, too, is happy with the relationship. According to him, Data Group is getting a needed capital infusion, access to NYNEX's state-of-the-art technology, and a chance to fit into the phone company's "total solutions" program, which offers customers a wide variety of different telecommunications services and will, Atkinson hopes, be the source of lucrative new business for Data Group.

What does NYNEX get out of the deal? The chance to expand beyond the regulated telephone business and the infusion of the kind of entrepreneurial mentality a mature corporation often lacks, Atkinson says. "They need companies with lean-mean spirit."

What lies ahead for the software industry? More of the same, according to just about everybody. "It's a very fragmented business, so there's a great deal of opportunity for people who are clever to try to put something together," says analyst Miller.

There are always new businesses to buy. Beyond the forces of synergy-hungry insurance companies and investment bankers looking for a fee lies the seemingly immutable fact about the software industry: it offers lots of opportunity to entrepreneurs, thanks to an entry level that still puts low risk on failing and hands out extremely high rewards to those who succeed—and that's another reason why, like crabgrass, new software companies keep popping up all over. ◉

Gail Collins is a reporter for the New York *Daily News* who writes frequently on financial matters.

No one expects ISDN to arrive tomorrow. But will it be like waiting for Godot?

WAITING FOR ISDN

by Dana Blankenhorn

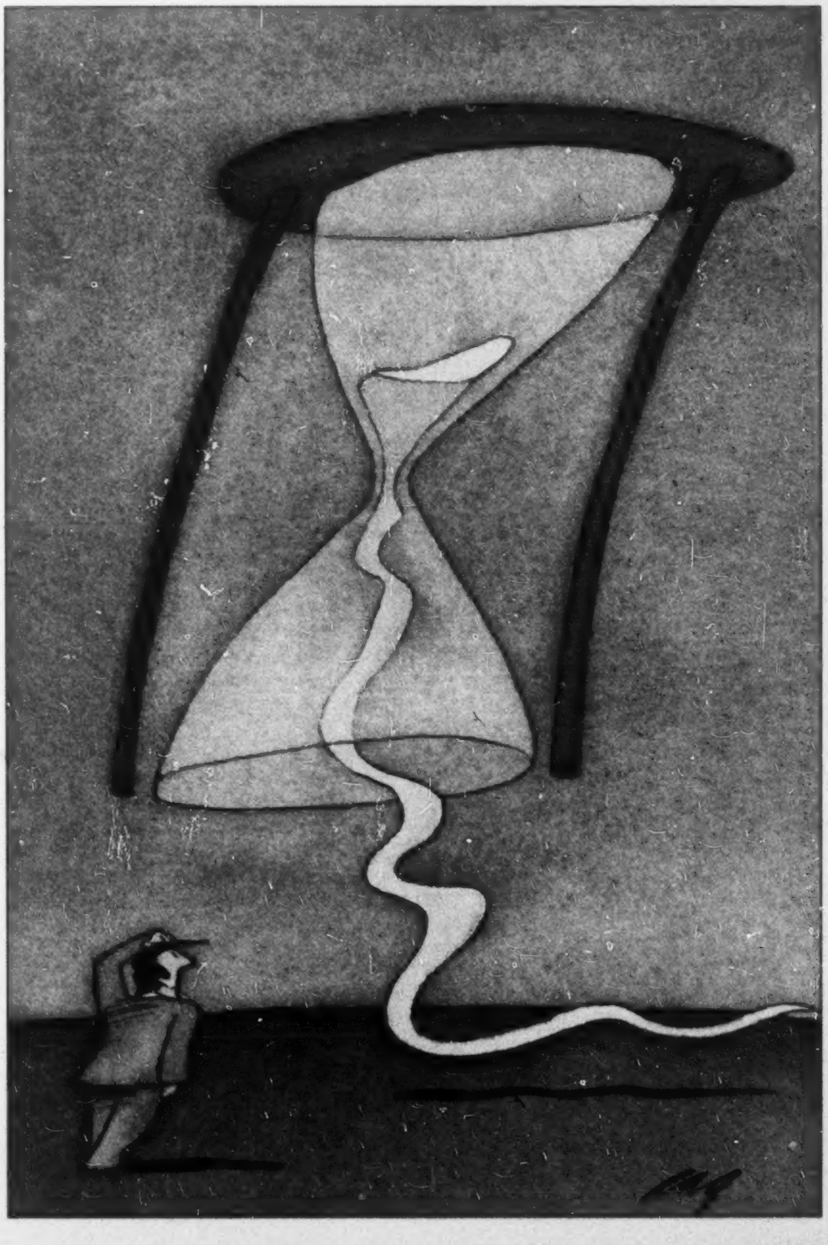


ILLUSTRATION BY RICH GOLDBERG

The integrated services digital network is coming, but not quite as soon as its boosters thought just a few years ago.

Major tests of ISDN-compatible switches have been delayed. Major portions of the standards underlying ISDN have yet to be agreed upon. European and American views of the final standards still differ substantially.

AT&T, Northern Telecom, and others continue to beat the drum for ISDN, but the sound is beginning to seem hollow. "In a way, ISDN is just a label for a natural evolution that has to take place," says T. Doane Perry III, senior research analyst in telecommunications for International Data Corp., Framingham, Mass. "What is amazing," he adds, "is that it has become such a big buzzword, and such a big piece of hype."

ISDN is the name given to an emerging set of standards for a global telecommunications network that will eventually deliver voice, data, image, and text in digitized form (see "ISDN: What It Is," and see also "The Integrated Service Digital Network," Dec. 1, 1984). There may be competing ISDN networks within national boundaries, but from the user's point of view, ISDN will look like a single, uniformly accessible worldwide network.

In 1984, over 30 recommendations primarily defining the customer interface to ISDN were adopted by the International Telegraph and Telephone Consultative Committee (CCITT) in Geneva, the group that is setting ISDN standards. Interim decisions have been made since then, but the next major batch of standards, which will provide refinements to the interface and more details on internal network functions, are due to be issued in 1988.

By now, more than one company has put a lot of marketing muscle behind the idea. Last March, AT&T based its entire booth at the Interface '86 data communications show in Atlanta on ISDN. "We have got to provide a technology environment

"What's amazing is that it's become such a big buzzword and such a big piece of hype."

marked by pervasive intelligence," said James Olson, AT&T president, in his keynote address to the Interface crowd.

For the telephone companies, ISDN represents long-term strategy. For their suppliers (see Fig. 1), ISDN is a multibillion dollar opportunity. For users, ISDN today mostly means hard questions without easy answers. For most, ISDN holds simply the far-off promise of reducing communications costs by eliminating the need for separate networks and some related transmission equipment, like modems.

FIG. 1

THE ISDN HORSE RACE

COMPANY	ESTIMATED 1986 SWITCHING EQUIPMENT SALES ($MILLION)	CAPTIVE DOMESTIC MARKET	CAPTIVE CHIP MANUFACTURING
AT&T	4,000	No	Yes
CIT Alcatel	650	Yes	Yes
DSC	130	No	No
Ericsson	1,570	No	No
Fujitsu	450	Sort of	Yes
GEC	400	Was	Yes
GTE	1,100	Yes	Yes
Harris	30	No	Yes
Hitachi	300	Sort of	Yes
IBM/Rolm	700	No	Yes
ITT	2,000	Some	Yes
Mitel	350	Partly	Yes
NEC	1,400	Sort of	Yes
NT	1,800	Yes	Yes
Philips	200	Hardly	Yes
Plessey/Stromberg	450	Was	Yes
Siemens	2,900	Yes	Yes

Source: International Resource Development Inc.

Some observers are troubled that major portions of the specifications for ISDN remain unsettled, a situation that has led people to joke that ISDN really means "I Still Don't Know." CCITT is now under the gun to reconcile European and American schemes for, among other things, international connections.

The role of IBM in a future global network is another unknown (see "IBM on ISDN"). While endorsing the ISDN concept, IBM has stressed, through its Rolm subsidiary, that it's premature to talk of ISDN as if it were a living reality. With its 16.6% interest in MCI Communications, however, IBM could be positioning itself to participate no matter how the ultimate standards are defined.

A LONG, EXPENSIVE PROCESS

This much is clear. Building ISDN will be a long and expensive process. The first steps are being taken by telephone companies right now. They're upgrading roughly 12,000 central offices with the latest digital switches, which will be able to handle ISDN features when they appear. For digital switch-makers in the U.S., the ISDN game will be won or lost in the next few years.

We're talking here about switches that cost from $1 million to $50 million each, like the AT&T 5ESS, the Siemens EWSD, the Northern Telecom DMS-100, the GTE GTD 5-EAX, and the NEC 61E.

AT&T and Northern Telecom currently have most of this business. Firms like Siemens, NEC, Ericsson, GTE, CIT-Alcatel, DSC, and Stromberg-Carlson want a piece of the action.

These switches are merely "ISDN capable," says Jean Buffham, a research analyst for International Resources Development, Norwalk, Conn., because ISDN standards have not been fully settled yet. The switch-makers "are banking on the fact the architecture is open enough to hook up to future standards," she adds.

To AT&T, the ISDN-capable 5ESS switch is critical to its success. But the company has already stumbled with this product. Customers were told in February the 5ESS would be delayed until December 1986. AT&T has suggested that the postponement was caused by complexities inherent in the switch software and by such projects as its obligation under the breakup agreement with the Justice Department to make network modifications necessary to guarantee long-distance competitors equal access. AT&T spokesman Sue Fleming says further "delay will come in the speed with which they get additional ISDN features."

For Northern Telecom, the DMS-100 switch, of which over 1,000 have been installed, has come to be a flagship product. It's an opening through which the company hopes to move more PBXs, voice/data terminals, and other ISDN-compatible office equipment. More than a year ago, Northern Telecom began shipping a software product called Integrated Business Network (IBN), which offers services similar to AT&T's Centrex. "Our ISDN trials will let us reuse that software, so we'll have compatibility between ISDN and IBN," says Ian Sugarbroad, general manager for ISDN at Northern Telecom's offices in Research Triangle Park, N.C. "We'll start our trial a month later than AT&T, but we'll have more applications."

Ericsson of Sweden, CIT-Alcatel of France, and Stromberg-Carlson, a subsidiary of the U.K.'s Plessey, are each preparing to market ISDN switches in the U.S.

Siemens, already a major contender in the European market, believes its EWSD has a good chance to secure a foothold for the company in the huge North American market. The West German firm is now discussing a possible joint venture with GTE for U.S.-made digital switches. IRD's Buffham expects more joint ventures. Companies won't be able to do it alone, she believes, because "the outlay of cash to put together these operations is too" great.

For DSC, formerly called Digital Switch Corp., digital switching is the whole ballgame. The Dallas-based company is much smaller than its rivals (1984 sales: $352 million). Its survival depends on selling to niche market players like Continental Telecom and United Telecom, and to long-distance firms like US Sprint and MCI.

The most important U.S. customers of the digital switch-makers are the seven regional Bell holding companies and their telephone subsidiaries, which will be conducting most of the domestic testing of the new generation of ISDN-capable digital switches. They will all test ISDN switches between now and the end of 1987. Analysts expect most of them to settle on three suppliers each. That way they get the benefits of competitive sourcing but don't have to handle too many redundant spare parts.

The tests, however, are modest. Ameritech is planning a widely publicized test at McDonald's headquarters in Oak Brook, Ill., this December. Originally scheduled for December 1985, it was delayed after AT&T postponed the release of its 5ESS switch. Bell Atlantic is doing customer demonstrations and market research in four cities. NYNEX is testing Siemens switches and conducting market research in New York City.

Pacific Telesis will test switches in San Francisco and San Jose, and run a test it is calling Project Victoria in Danville, Calif. Project Victoria involves putting five data and two voice channels into an ISDN phone line that has roughly half the bandwidth that is envisioned under ISDN.

Southwestern Bell will test Northern Telecom and AT&T switches internally at its St. Louis headquarters. U.S. West will demonstrate four brands of switches for the International Switching Symposium in Phoenix next March. BellSouth is connecting two brands of central office switches, Northern's and AT&T's, to customers in Atlanta. BellSouth doesn't call its move a test; rather, it's described as a "roll-out."

ISDN EQUIPMENT TO TOUR

This summer, phone customers may see the kind of equipment ISDN will require. Both Siemens and Northern Telecom will send trucks loaded with ISDN-like equipment on tours of telephone company offices for hands-on demonstrations.

Wisconsin Bell sponsored a similar truck tour for Siemens last year. Scott W. Augerson, senior product manager for Siemens in Boca Raton, Fla., says running the facsimile machines at 64Kbps "really shows them the potential."

What is that potential? One 64Kbps B channel (the standard channel for regular voice and data transmission in ISDN) is more than enough for clear, digitized conversation. The fastest pc modems are moving data at only 10Kbps to 20Kbps. At 64Kbps, pages run through a facsimile machine as fast as through a photocopier.

Still, there are complaints. "The ISDN trials do not consist of the movement of data through the network," says communications consultant Gerald Ryan of Connections Inc., Bridgewater, Mass. "They consist of interfacing with some switch, and what takes over at that point is the normal transmission of data. The full implementation of ISDN as a network data transfer is nowhere near trial."

While the switches being tested by the phone companies are up-to-date, upgrading these switches to provide ISDN functionality will require additions to software and, in some cases, new plug-in boards. When such switches are installed today, analog-based POTS (plain old telephone service) is still the rule. As we've seen, even the trials are limited. Fact is, while the basic rules of the ISDN game are established, the i's aren't all dotted and the t's aren't all crossed yet on the standards.

Before selling chips and connectors for linking PBXs, pcs, or fax machines to an ISDN network, such equipment must be able to interpret signals received through the D channel (the ISDN channel reserved for passing control messages). If you're talking on the phone today and have call-waiting, for instance, you'll hear a beeping tone for the second call, a tone that can kick a modem off-line. This is called "in-band" signaling, and will disappear under ISDN.

To use the ISDN D channel, PBX equipment and office machines must be modified to accept "out-of-band" signaling—but standards for this are not final.

NOT EVEN SHAPE OF PLUG SET

Study Group 18 of the CCITT hasn't settled on the shape of plug that machines will use to connect to ISDN, let alone the logical, software-based connections. There are seven different logical protocol levels involved in passing control signals to customer machines through an ISDN D channel. The first three, based on the Open Systems Interconnection (OSI) reference model, appear set. But all must be settled before manufacturers install ISDN chips or connectors in new products, let alone before plug-in board-makers start fitting pcs or facsimiles or telex machines to work with ISDN.

"At present the standards are not set, so we're trying to find a graceful transition in the present trials," says Patrick Bonds of Northern Telecom. "There will be hybrid signaling in the interim."

Most of the other unsettled ISDN standards questions involve basic differences between current North American communications standards and those used in Europe.

- Will the software required by various interfaces between the customer and the network be located in the customer's equipment, or at the telephone company's central switching station?

This central issue is part of the great tug of war between AT&T and IBM. If the software is placed in the customer's equipment, then widespread implementation of ISDN will depend on the availability of user devices made ISDN-capable with special logic chips. In that case, specific standards will have to meet with wide agreement.

If software implementing ISDN interfaces are lodged in the switch, fewer changes will be required of customer-premise equipment to implement ISDN.

- What error detection scheme will be used within ISDN?

This relates to differences between European and North American networks. Europeans use 31 clear 64Kbps channels,

ISDN: WHAT IT IS

The term ISDN is used to refer to both the standards set by the International Telegraph and Telephone Consultative Committee (CCITT) and to the network that is supposed to be formed based on those standards. By the year 2000, telecommunication customers should be able to send data, sound, pictures, or print in the same way, through the same type of system, anywhere in the world.

Today many central offices along the long distance phone networks exchange digital signals with each other, but most receive analog signals from telephones. With ISDN, all transmissions to and from end-user devices will be digitized, either directly or after conversion by such customer-premises equipment (CPE) as a digital PBX. The ISDN model is essentially an end-to-end switched digital telecommunication network.

Intelligence and capacity are two key ideas behind ISDN. There are two kinds of ISDN access service: basic and primary.

Basic access service is referred to as "2B+D" and consists of two 64Kbps B channels and one 16Kbps D channel. The letters refer to the function, not bandwidth, of the channels. The B channels are used for all data other than control messages. The D channel is the conduit for out-of-band control messages, and is used to specify, for example, what devices are plugged in at either end of a connection.

The control messages give the network intelligence. As Scott Augerson, senior product manager for Siemens Information Systems, Boca Raton, Fla., explains, "You'll have one number—no need for separate numbers to the fax, telex, pcs, etc. The network figures out which device the call is for."

Primary access service will be offered to commercial customers of an ISDN who want to hook up their PBXs or LANs. It consists of multiple 64Kbps channels. There will be two "primary access" connections: one will consist of 24 channels, the favorite of North American designers, and the other will have 31 channels, the preference in Europe.

The 24-channel connection, or "pipe," offers a 1,544Kbps bandwidth divided into 23 64Kbps B channels and one 64Kbps D channel. The 23 B channels can be combined to deliver a digitized tv-like signal; portions of it can be used to deliver lower-level Picturephone or teleconferencing service; or the "23B+D" pipe can be used to augment even the networks and satellite networks businesses already have. This capacity is possible by using copper, but its ubiquity will be made possible as copper is replaced by fiber optic cable.

—D.B.

IBM ON ISDN

ISDN is part of the larger poker game between AT&T and IBM for leadership in the information industry. In this battle, however, IBM does not hold all the aces.

Big Blue's preference for proprietary standards is threatened by the all-pervasive nature of ISDN. While IBM representatives sit on ISDN standards committees, and its Rolm subsidiary is a major player in the digital PBX market (a major ISDN battlefield), Big Blue is, for the most part, on the outside looking in at ISDN. For now.

But no one is yet calling ISDN a living reality. "What we've said in the past is that it will be the late 1980s or early 1990s before real ISDN products appear," says Rolm spokesperson Sherry Fahey.

In its Rolm subsidiary's "ISDN Position Statement" published last December, the firm emphasizes the importance of Rolmlink, "a proprietary desktop interface similar to the ISDN basic (2B+D) interface," calling it "the first high-volume implementation of an ISDN-like product in North America." The statement adds that IBM will continue support for non-ISDN standards, including the IBM token ring network, SNA, and X.25.

"This philosophy will allow a Rolm CBX to support both ISDN primary (23B+D) and basic (2B+D) interfaces in addition to the non-ISDN connections, ensuring protection of investment already made," according to the statement (see "ISDN: What It Is"). CBX is the brand name of Rolm's entry in the PBX market.

The statement goes on to emphasize that ISDN standards are not fully in place, that there are differences between European and American ISDN, and that "multiple ISDN networks could evolve in North America" from AT&T, Bell Operating Companies, MCI, GTE, and others.

Rolm's position echoes those of analysts who say more user input is needed in ISDN. "Users have not, to date," the Rolm position paper continues, "participated significantly in the standards process and the usefulness, practicality, and bottom-line cost benefits of ISDN are not clear. This viewpoint has been expressed by many users in forums across the country. The applications or services that ISDN will provide are not defined and the benefits to customers remain very hazy."

What's not hazy is IBM's desire to offer those benefits. In selling its money-losing Satellite Business Systems subsidiary to MCI Communications, Washington, D.C., last year, IBM acquired a 16.6% stake in MCI. As a long distance company, MCI will have to handle ISDN services no matter what standards are finally set. John Hauser, an MCI spokesman, agrees, and says the firm is steadily increasing its datacom workload as ISDN approaches. "Our MCI DataTransport packet-switching is an ISDN service. We are working with the standards-setting committees and we'll be ready to implement full ISDN when it arrives."

Recently, IBM lost a battle when the CCITT decided against adopting SNA layers as part of the OSI protocol (see "Benchmarks," April 1, p. 24).

But the issue remains important. "The fight is over how ISDN and SNA work together," says Fred Knight of the newsletter *ISDN Strategies*.

While IBM will not comment on future product announcements, analyst Frank Dzubeck of Communication Network Architects Inc., Washington, D.C., says products developed by IBM Europe will come out this year that will illustrate its strategy: "IBM/Rolm will release an ISDN interface for the PC with a 64,000-baud [64Kbps] channel for data transmission through the Rolm CBX," he says.

"What IBM does in the future will be very important," says Buffham of IRD. "They're a big question mark at this point. Are they going to make a play for the telecommunications market and come out with a digital switch? If not, what are they going to do with Rolm?" Consultant Gerald Ryan of Connections Inc. says IBM's recent decision to join the Corporation for Open Systems proves the company will eventually play ball on the CCITT's terms. "My impression is that IBM is moving very, very quickly, not slowly, in the way they have made themselves available," he says.

When the ISDN game gets serious, in other words, expect IBM to be there.

—D.B.

---

while American networks have 24 channels, each with 56Kbps of bandwidth and 8Kbps for in-band messaging. The question, according to Sugarbroad of Northern Telecom, is how Americans will operate at 64Kbps clear—without the 8Kbps in-band message bandwidth. The specific schemes, B8ZS (binary 8 zero substitution) and ZBTSI (zero byte times slot interchange), are incompatible techniques for handling errors that result from too many 1s or 0s in a row. Once these questions are settled, there will be more, adds Northern Telecom's Sugarbroad.

John Newell, who heads data interfaces for AT&T research and development, insists the important standards work is done and that ISDN is going forward faster than critics think. "Silicon VLSI suppliers feel the standards are sufficiently defined to do chips in support of these interfaces, including American Micro Devices (AMD) and Intel in the U.S., and Siemens, Mitel, and Ericsson internationally."

Newell also minimizes the remaining standards issues. "I'm not sure of the status of the plug, but the electrical characteristics, the transmission modes, the data formats, and their speeds have all been settled, and people who are knowledgeable feel domestic RJ-11 jack and plug combinations are perfectly adequate to support those transmissions." Nonetheless, since many decisions haven't been made yet, worldwide compatible designs can't be set.

GETTING READY FOR ISDN

Right now, the market research being done by the phone companies tells them to go full speed ahead. "One study we did with a customer with 300 potential terminals estimated $10,000 per month could be saved by simplifying office moves" with ISDN, says Paul Bayliss, director of market planning and management for AT&T Network Systems. "Banking, insurance, financial services, health care, high-tech manufacturing, and universities all have high potential as markets."

Analysts admit ISDN sounds real exciting but they're suspicious that the current excitement is much ado about nothing. IDC's Perry says that the only thing users need to know right now is that their phone lines are going to get better.

A key question for users and vendors alike is the extent to which ISDN will require that computers and telephone equipment adapt to some new universal standard.

Perry, for one, doesn't see that coming. "What won't happen is the universal standard that lets you switch among vendors. X.25 [the CCITT standard for packet-switching network protocols] didn't provide that—Tymnet's still different from Telenet—and ISDN won't do it either."

In the transition to ISDN, new problems can result. Fred S. Knight, editor of the newsletter, *ISDN Strategies*, explains one. "The conversion will effect T1 multiplexing. Data are formatted for T1 multiplexing through a format called T1-D3. T1-D3 and ISDN are not the same, so if AT&T can offer T1 speeds in the ISDN format, with software in their PBXs which formats data to the ISDN format, what's it do to people selling T1 multiplexors?" The lack of clarity in such matters assures the drumbeat of ISDN arguments will continue.

Of course, the basic question is what should you do about ISDN? "The main thing users should do is assure themselves that their planning fits into ISDN somehow," says Tom Super, assistant director for strategic technical planning at NYNEX, White Plains, N.Y. The one thing you probably should not do about ISDN is lose any sleep over it, unless you sell big digital switches for a living, or have to buy one for your private communications network. The rule is walk, don't run, to tomorrow. ◉

Dana Blankenhorn is a free-lance writer in Atlanta.

C 8650-1A

DATAMATION

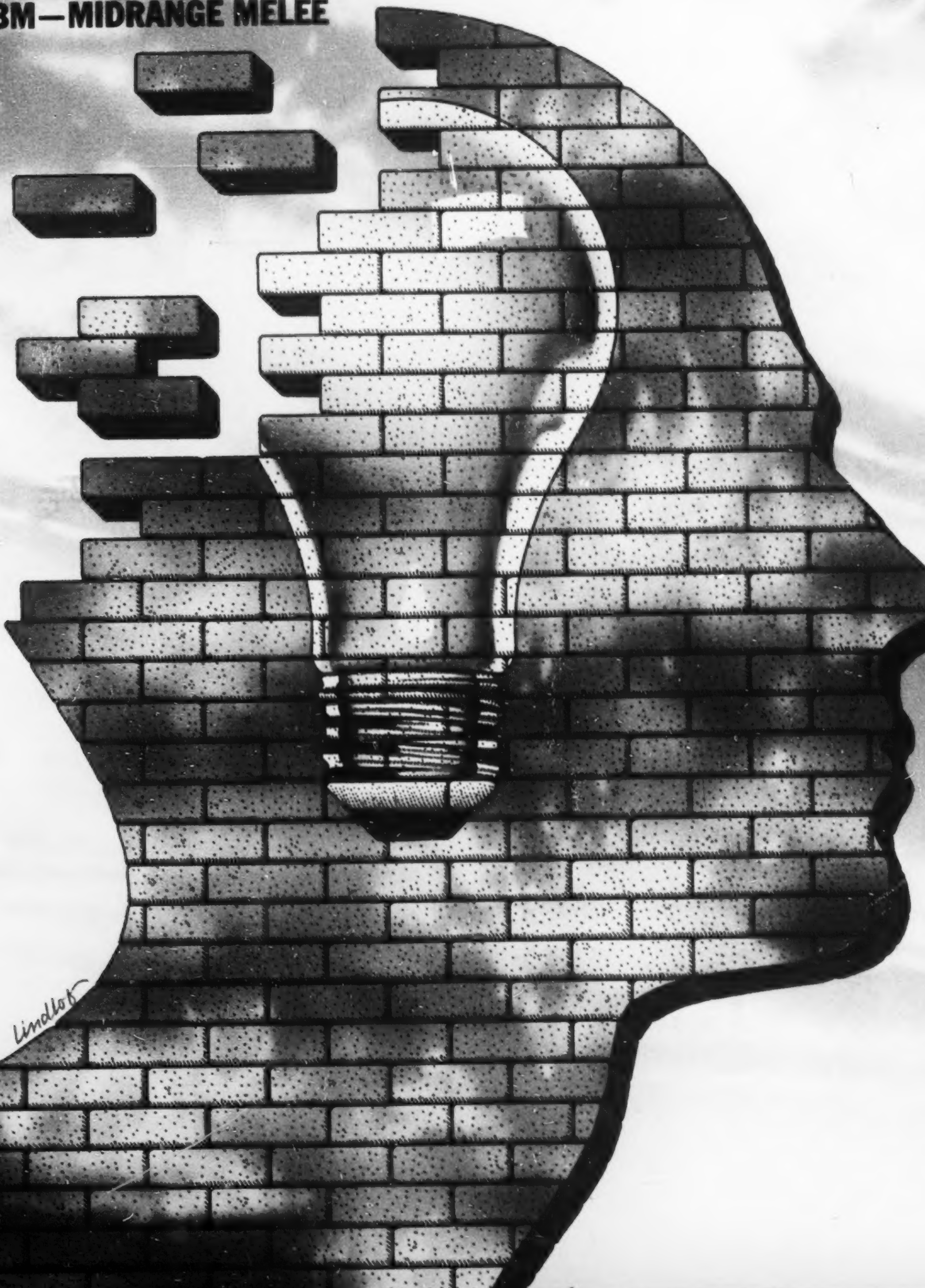
86
INTERNATIONAL EDITION AUGUST 1 © TECHNICAL PUBLISHING

BUILDING ARTIFICIAL INTELLIGENCE... IN THE LAB, IN THE MARKETPLACE

PLUS:

THE TOP 25 EUROPEAN DP COMPANIES

DEC VS. IBM—MIDRANGE MELEE



DATAMATION

AUGUST 1, 1986/$3 U.S.A.
VOLUME 32 NUMBER 15
This issue, 193,190 copies

FEATURES

34
EUROPE'S ELITE
Paul Tate and Linda Runyan

The top 25 companies in the European market last year had revenues totaling $34.5 billion, up 21% in dollars over the year before. This and more in the annual DATAMATION European 25 survey.

41
VIEW FROM THE TOP
A DATAMATION Round Table

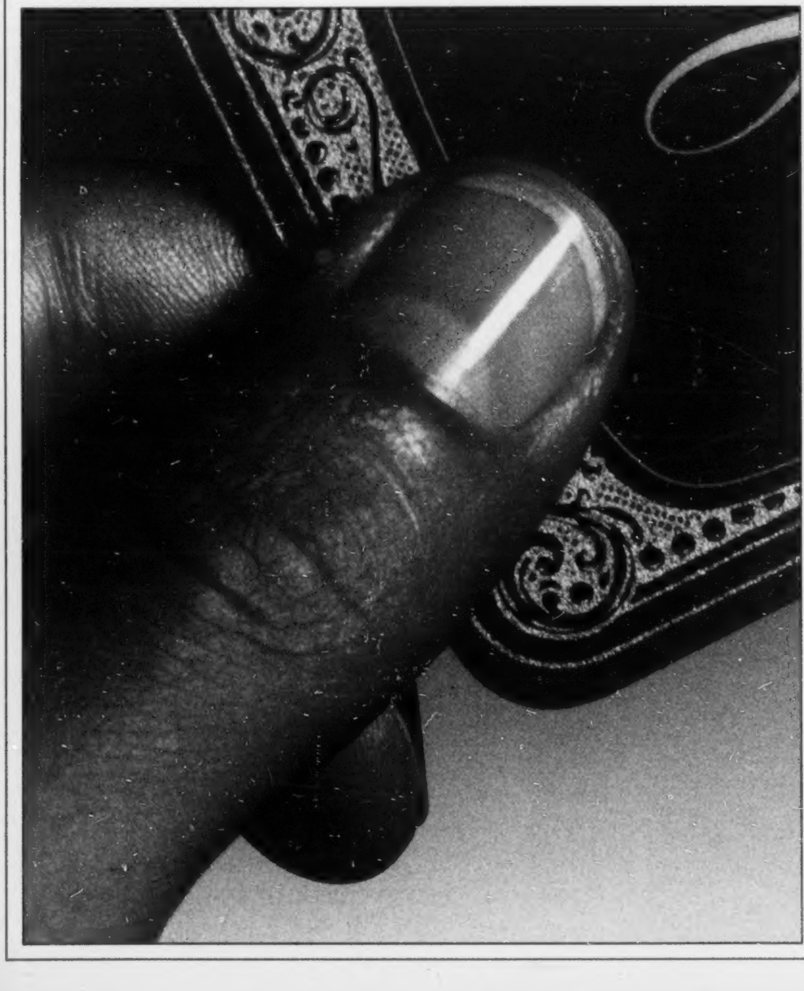
Six top European dp executives were invited to give their viewpoints on current trends in European data processing, and what future directions may be. Excerpts from that discussion are presented herewith.

46
BUILDING AI BEHIND CLOSED DOORS
Edward M. Fisher

In the seldom examined world of artificial intelligence research, the technology on which the field's future depends is now being developed.

55
THE LISP RACE HEATS UP
John W. Verity

Artificial intelligence, long derided as a trivial, academic pursuit, is getting to be big business. The question is, can the pioneers stay ahead as the market broadens and AI techniques seep into traditional spheres of computing?



NEWS IN PERSPECTIVE

18 **MIDRANGE SYSTEMS**
IBM, DEC debate architectures.

20 **NETWORKS**
Starlan may be fading.

23 **CONTRACTS**
Wang in tussle down under.

26 **LABOR**
Offshore data entry picks up.

31 **BENCHMARKS**

DEPARTMENTS

9 **LOOK AHEAD**
15 **LETTERS**
61 **PEOPLE**
65 **HARDWARE**
69 **SOFTWARE**
73 **SOURCE DATA**
76 **ADVERTISERS' INDEX**

INTERNATIONAL 44-1

(DOES NOT APPEAR IN ALL EDITIONS)

-5 **ONE-WAY TRAFFIC**
-11 **TAPPING INTO THE TREASURY**
-15 **DESIGNER DP**

COVER ILLUSTRATION BY ED LINDLOF

LETTERS

DEVIL'S DUE

I was delighted to read "Is It Real, or Is It 'Information,' " by John W. Verity (May 15, p. 23). It provides a welcome change in our professional fare.

I urge you to open space in your magazine for what I would call a "devil's advocate" corner. Too many views and articles in the past have been almost exclusively on the positive, selling side of our exciting technology. We are still paying for having accepted these views too readily.

The problems that society has in coping with computers and communications are new, the future hard to predict. A dialog in the devil's advocate corner of your Readers' Forum would help to clarify the issues and positions and it might lead to a more effective use of our hardware, for the benefit of society.

JACEK KRYT
Willowdale, Ontario

WHAT HAPPENED?

I found "Whatever Happened to Structured Analysis?" by Ed Yourdon (June 1, p. 133) amazingly downbeat on the subject of structured design and analysis. Our department is currently in the process of implementing standards, and I had hoped that the article would provide support for my efforts to incorporate Yourdon's methods into them. Instead, the article has made me more conservative about pushing for structured methods in the organization.

RICHARD BARTHOLOMEW
Data Systems Division
General Dynamics
North Kingstown, Rhode Island

THOU SHALT NOT . . .

Your excellent editorial, "Let Not History Lead the Leader," (May 1, p. 19) omits the Fourth Commandment of Standards Making:

IV. Thou shalt not let national variations prevail.

The standards world has a unique opportunity to establish truly global standards if Lincoln Faurer and the Corporation for Open Systems work closely with the European SPAG (Standards Promotion and Application Group) to ensure the emergence of a single set of standards. This opportunity comes only once in the history of an industry—it must not be thrown away!

P.O. GERSHON
Director, Network Systems
International Computers Ltd.
Basingstoke, Hants
England

DISTRACTING

As I was distributing mail for our branch, I came across the June 1 issue of DATAMATION and was disgusted at the cover. The pornographic display of people wearing bikinis has no relevance to the contents of the magazine. Not only does it distract the unexpecting men, but it does not do justice to the image of your magazine. I would like to strongly encourage your company to be more cautious about taking negative liberties.

H.J. RHEE
Greenbelt, Maryland

We did not mean to distract or insult any of our readers, only to symbolically describe Las Vegas, the site of this year's National Computer Conference.—Ed.

ANOTHER MEASURE

Omri Serlin's otherwise excellent "MIPS, Dhrystones, and Other Tales" (June 1, p. 112) on the vagaries of performance measurements on RISC machines fails to mention one of the most popular and widely used benchmarks in that area: the "Livermore Kernels." A version of them was probably first used to characterize the performance of that famous RISC machine, the CDC 6600.

The following quote, taken directly from that program's comments, seems quite appropriate: "Throughput is measured in units of floating point operations per microsecond, called . . . megaflops. The MFLOP is a measure of the necessary results in a scientific application program regardless of the number or kind of operations or processing. The ratio of MFLOPS for two different machines will approximate the ratio of through-puts for the majority of compute-limited scientific applications on the two machines."

The author goes on to differentiate between the "necessary mathematics" (floating point results) and procedural machine instructions which are "artifices of an architecture." All MIPS quotations, Dhrystone or otherwise, contain to varying and largely indeterminate degrees, elements of this artifice.

W.H. GRAY
Idaho Falls, Idaho

CORRECTIONS

Owing to errors made during the editing of Omri Serlin's "MIPS, Dhrystones, and Other Tales" (June 1, p. 112), Herman Goldstine's name was misspelled and the location of the U.K.'s National Physical Laboratory was misidentified. It is in Teddington, Middlesex.

Following publication of this article, Mr. Serlin has learned that the internal IBM technical report on the Gibson Mix was indeed published in 1970 (to document the work IBM staffer J.C. Gibson did on the IBM 650 and 704 machines over 10 years earlier). Mr. Serlin wishes to thank Steve Schlesinger of NCR for his help in resolving this matter.

In the profile of Atlantic Computers plc (June 15, p. 149) in the DATAMATION 100, the company's total revenues were described as its dp revenues; the company's dp revenues were £175 million as reported in the charts.

In the profile of Digital Equipment Corp. (p. 66), the company was described as the "first major vendor to endorse the seven-level OSI architectural standard . . . ." In truth, DEC was the first major *U.S.* vendor to do so.

Twenty-five top companies qualify for membership in the Continent's most prestigious computer club.

EUROPE'S ELITE

by Paul Tate and Linda Runyan

While Americans beefed about a slump, economic conditions on the Continent beefed up the 1985 revenues of Europe's leading data processing companies: the top 25 companies in the European market last year had revenues totaling $34.5 billion, up 21% in dollars over the year before.

As usual, the revenue range between the first- and last-place firms is very broad. Top-ranked IBM pulled in a staggering $13.4 billion, while bottom-rung Atlantic Computers chalked up $219.5 million in 1985 European computer sales. As was the case in our 1984 survey, Big Blue's European dp sales represented 39% of the combined revenue total.

The European dp market, which has always experienced more modest but steadier growth than the U.S., suffered much less in 1985 from the so-called slump in the computer business. This is reflected in the healthy 21% jump in combined revenues of the top 25 companies. Recent market surveys indicate that the European dp business grew by more than 15% last year to well over $40 billion; the combined revenues of the DATAMATION European 25 account for 86% of the European computer business.

One area that did especially well was software and services. According to the European Computer Services Association (ECSA), the European computer services and software business in 1985 was worth $15.4 billion, up 22% over the previous year. Breaking this down, packaged software soared 32%, custom software and consultancy grew 23%, and processing services inched up a modest 10%.

West Germany spent the most on data processing during 1985, followed by the other major markets in the U.K., France, and Italy.

The strong market in Germany helped the country's leading dp company, Siemens, hold on to the number two position in the 1985 ranking, with revenues of $2.8 billion. At the bottom of the chart, the names of the members may have changed, but the $219.5 million revenue threshold for membership in the top 25 club stayed almost the same as in 1984.

DRAMATIC DISPARITY REVEALED

Once again, DATAMATION's European ranking reveals the most dramatic disparity in revenues between the 13th and 14th positions. Holding its same 13th place slot is NCR, which posted a greatly improved 27% gain to $932.5 million. Falling far behind NCR in this revenue race is another American company, Honeywell, whose lower 6.9% increase to $487.9 million earned it notch number 14.

The 11 companies that fall below Honeywell are also once again closely clustered together on the DATAMATION European 25 chart, which cuts off at Britain's Atlantic Computers. That company recorded a spectacular 94.4% boost in European dp sales. Honeywell also appeared to be the biggest mover on the chart, vaulting five places to the number 14 spot. Honeywell's hike, however, is somewhat misleading. If the Minneapolis company had reported its complete 1984 European dp revenue to DATAMATION, it would have indeed ranked in the same 14th-place position it captured in our 1985 survey.

Four of the chart climbers rose two notches each in our ranking: BASF, Burroughs, Nixdorf, and Philips.

Three American companies fell the farthest on the DATAMATION European 25 chart. California company Hewlett-Packard plummeted five places to number 12 on an 8.1% revenue gain to $992.2 million. Another California concern, Apple Computer, nosedived five places to rank 23rd, on a decline of 27.7% in revenue to $227.9 million. And Commodore dropped four places to 19th on the ranking. Also slipping badly was the U.K. company Plessey, down four slots to 24th place.

There was more repositioning apparent on the 1985 chart. Five companies stayed in the same place, as opposed to six in 1984. Those companies were NCR, STC (ICL), Groupe Bull, Siemens, and IBM, which remained firmly entrenched in the numero uno position. The most stability in

CALLIGRAPHY BY RAY BARBER; PHOTOGRAPH BY STEVE COOPER

positioning comes again at the very top of the ranking. For the third year in a row, West German giant Siemens held on to its coveted second-place slot behind behemoth Big Blue. U.S. minicomputer maker Digital Equipment Corp. swapped places with Italian dynamo Olivetti to capture third place. This is the highest the Massachusetts mini maker has ever risen in DATAMATION's European 25.

DEC as well as other stateside system sellers took advantage of the more favorable economic and market conditions across the Atlantic. This is also reflected in the ranking, which once again for 1985 is dominated by the American contingent. The U.S., with a dozen dpers, has more companies on the chart than any single European country. The Yankee brigade pulled in $22 billion in European dp revenue, which represents 63.5% of the combined top 25 total. Adding to those American sales in Europe was survey newcomer Prime Computer Inc. Slipping off the chart for 1985 was Data General, which held last place in the 1984 ranking.

The European coterie, which includes 13 companies from six countries, had combined sales of $12.5 billion, almost half of the American total. Included in the European fold are four firms each from West Germany and Britain, two from France, and one each from Sweden, Italy, and the Netherlands. Fifteenth-place British Telecom, which had revenues of $455.1 million, is a new entrant to the top 25. Returning to the ranks of the European elite is Compagnie Générale d'Electricité, which scored $431.1 in European dp sales. The French firm moves back onto the chart because of the consolidation and restructuring that has gone on within the CGE group. The business systems and communications branches of CGE and Thomson were merged into a new CGE subsidiary, Thomson Alcatel.

DIDN'T QUITE MAKE IT

The European company that fell off the chart in 1986 was Rank Xerox, which took in revenues of $216 million. In our 1985 survey, there was heated competition for the last-but-not-least spot. Rivals for that 25th position included Finland's Nokia, a near miss at $217.6 million, Amdahl at $215.5 million, and, of course, Rank Xerox at $216 million.

Seven European companies that are on the list of firms with the largest worldwide dp sales are not on the DATAMATION European 25 because their European computer revenues fall below the $219.5 million cutoff point. Those companies are Racal,

FIG. 1

LEADING EUROPEAN DP COMPANIES

	COMPANY	COUNTRY	WORLD-WIDE DP REV ($ MIL)	% CHG ACTUAL ACCTG. CURRENCY
1	**Siemens AG**	W. Germany	$3,265.0	20.8
2	**Ing. C. Olivetti & Co. S.P.A.**	Italy	2,637.7	42.4
3	**Groupe Bull**	France	1,794.5	18.5
4	**N.V. Philips**	Netherlands	1,365.6	13.4
5	**Nixdorf Computer AG**	W. Germany	1,339.9	20.5
6	**STC plc**	U.K.	1,330.8	10.0
7	**L.M. Ericsson**	Sweden	1,232.8	14.1
8	**Compagnie Générale d'Electricité**	France	479.0	10.3
9	**British Telecom plc**	U.K.	455.1	NA
10	**Volkswagen AG**	W. Germany	452.9	19.7
11	**Racal Electronics plc**	U.K.	380.8	−14.7
12	**BASF**	W. Germany	357.1	23.5
13	**Mannesmann AG**	W. Germany	355.7	7.0
14	**Ferranti plc**	U.K.	282.1	10.3
15	**Rank Xerox**	U.K.	270.0	13.4
16	**Plessey Co. plc**	U.K.	250.0	10.3
17	**Cap Gemini Sogeti**	France	245.1	22.2
18	**Atlantic Computers plc**	U.K.	224.4	94.4
19	**Norsk Data AS**	Norway	219.8	36.8
20	**Nokia Corp.**	Finland	217.6	24.2

FIG. 2

IBM EUROPE'S MAJOR MARKETS

COUNTRY	1985 TOTAL REV ($ MIL)	% CHANGE IN ACC*	INTER-CO. TRANSFER ($ MIL)	LOCAL SALES REV ($ MIL)	1985 NET INCOME ($ MIL)
France	$4,183.4	13	$1,920.2	$2,263.2	322.1
W. Germany	4,500.0	17	1,693.5	2,806.5	289.8
Italy	2,241.5	17	707.0	1,534.5	250.3
Netherlands	1,032.5	26	356.3	676.2	100.6
Spain	1,128.9	38	519.9	609.0	128.8
Sweden	846.4	25	354.1	492.3	66.2
U.K.	3,901.3	30	2,028.2	1,873.1	394.9

All figures include typewriter sales, which have been deducted from DATAMATION European 25 chart.
*Actual accounting currency

METHODOLOGY

For this survey, Europe includes Austria, Belgium, Denmark, Finland, France, West Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Norway, Portugal, Spain, Sweden, and the U.K.

Dp-related revenue is defined as general purpose dp products and services generated by one or more of the following categories of equipment: mainframes, minicomputers, office systems, data communications, peripherals and terminals, software and services, and maintenance and repair. Excluded are data transmission or "basic" services revenues from specialized common carriers, standalone electronic and mag card typewriters and standalone electronic cash registers, instrumentation, semiconductors, printed circuit boards, automated test equipment, and dp supplies, with the exception of magnetic media for disk and tape drives. All peripherals that attach to a system are included. For computer-based manufacturing systems, such as computer-controlled machine tools, only computer and hardcopy output devices are included and not the tools themselves.

All revenue and earnings figures have been adjusted to calendar year calculations. All European company figures were converted to U.S. dollars, using OECD exchange rates.

THE DATAMATION EUROPEAN 25

1985 RANK	1984 RANK	COMPANY	HEAD-QUARTERS	1985 EUR DP REV ($ MIL)	% CHG $ U.S.	% CHG AAC*	TOTAL DP REV ($ MIL)
1	1	**International Business Machines**	U.S.	$13,440.2	18.0	18.0	$48,554.0
2	2	**Siemens AG**	W. Germany	2,775.2	16.9	20.0	3,265.0
3	4	**Digital Equipment Corp.**	U.S.	2,179.1	34.5	34.5	7,029.4
4	3	**Ing. C. Olivetti & Co. S.P.A.**	Italy	1,862.8	23.4	34.8	2,637.7
5	5	**Groupe Bull**	France	1,668.8	15.4	18.5	1,794.5
6	8	**Nixdorf Computer AG**	W. Germany	1,192.5	16.7	20.5	1,339.9
7	9	**Burroughs Corp.**	U.S.	1,124.4	19.0	19.0	4,685.3
8	6	**L. M. Ericsson**	Sweden	1,097.1	8.5	12.8	1,232.8
9	11	**N.V. Philips Gloeilampenfabrieken**	Netherlands	1,078.2	28.4	24.2	1,365.6
10	10	**STC plc**	U.K.	1,038.0	10.0	14.4	1,330.8
11	12	**Sperry Corp.**	U.S.	1,020.0	41	41	4,755.1
12	7	**Hewlett-Packard Co.**	U.S.	992.2	8.1	8.1	3,675.0
13	13	**NCR Corp.**	U.S.	932.5	27.0	27.0	3,885.5
14	19	**Honeywell Inc.**	U.S.	487.9	6.9	6.9	1,951.9
15	—	**British Telecom**	U.K.	455.1	NA	NA	455.1
16	14	**Wang Laboratories Inc.**	U.S.	437.0	NC	NC	2,428.3
17	—	**Compagnie Generale d'Electricite**	France	431.1	NA	NA	479.0
18	16	**Control Data Corp.**	U.S.	423.0	12.8	12.8	3,679.7
19	15	**Commodore International Ltd.**	U.S.	397.5	−4.0	−4.0	750.0
20	17	**Mannesmann AG**	W. Germany	320.1	3.0	7.0	355.7
21	23	**BASF**	W. Germany	282.1	33.3	37.4	357.1
22	—	**Prime Computer Inc.**	U.S.	238.6	37.5	37.5	769.7
23	18	**Apple Computer Corp.**	U.S.	227.9	−27.7	−27.7	1,753.8
24	20	**Plessey Co. plc**	U.K.	225.0	−13.8	−10.3	250.0
25	—	**Atlantic Computers plc**	U.K.	219.5	87.0	94.4	224.4

NA: not available; NC: no change *Actual accounting currency

Ferranti, Nokia, Norsk Data, Rank Xerox, Cap Gemini Sogeti, and Volkswagen AG, the parent of West Germany's Triumph Adler.

Many other European companies had something to shout about last year too. France's Bull went into the black after years of losses, Britain's STC crossed the 1 billion mark in pounds sterling, and the long-standing dp and communications divisions of the Dutch Philips group merged. It was also the first full year of operation for the newly financed British Telecom (BT), the U.K.'s national telephone authority. During its first year in the private sector, the firm earned enough in the dp and private digital communications markets to qualify it for 15th place in the DATAMATION European 25 ranking. Making its debut there, BT had one of the strongest profit pictures in the industry during 1985. According to the DATAMATION 100, British Telecom has the fourth-highest net return on sales worldwide. IBM is one position lower (see "The DATAMATION 100," June 15, p. 42).

Even so, IBM had a good year in Europe during 1985 with mainframe sales buoyant and personal computers dominating all the national markets. Last year, IBM's European revenues, which were up 18%, accounted for 27.7% of the company's worldwide sales. That was the first increase since the '70s. Each of its major European subsidiaries showed strong growth rates, especially in the U.K. and the fast-expanding markets in Spain and the Netherlands (see Fig. 2).

SIERRAS POPULAR IN EUROPE

Last year, the Sierra mainframes were much in demand in Europe, a demand that benefited both IBM and leasing companies like DATAMATION European 25 newcomer Atlantic Computers. The U.K. firm had taken orders for 12 IBM 3090 systems by year-end.

IBM's relationship with the leasing industry as a whole worsened, however. The European Computer Leasing Association (Eclat) filed a complaint with the country's office of fair trading practice over IBM Germany's abuse of its dominant market position. The investigation is still under way.

At the lower end of the business, IBM established itself as a clear winner in the European micro field. Market surveys give IBM more than one third of the professional pc business. Meanwhile, Olivetti, with 11% of the market, knocked Apple out of the number two spot. Since the general purpose pc market is well supplied, European pc makers are customizing micros for more specialized applications. Olivetti and Philips, for example, have introduced or are preparing products that integrate such technologies as voice, compact disk, magnetic card readers, and high-resolution graphics. This wave of applied microcomputing is an inevitable result of the more conservative pc purchasing attitudes in Europe, where buyers want to automate specific jobs to cost-justify their investments.

While the big folks in pcs battled it out for market share, other European micro makers were suffering from market fallout last year. According to a U.K. National Computing Center report, around 30% of Britain's micro firms dropped out of the market in Britain in 1985. But even more new suppliers set up shop, and overall the number of pc suppliers in the U.K. was up 11% last year.

TOTAL DP REV % CHG ($ MIL)	1985 TOTAL REV ($ MIL)	EUR DP REV AS % OF TOTAL DP REV	DOM REV AS % OF TOTAL DP REV	DP REV AS % OF TOTAL REV	NET INCOME ($ MIL)	1985 EMPL	FISCAL YEAR END
9.6	$50,056.0	27.7	64	97	$6,555.0	405,535	Dec.
17.0	18,574.9	85	50	18	519.7	348,000	Sept.
12.8	7,029.4	31	60	100	400.6	91,000	June
31.0	3,215.9	71	36	82	250.0	48,944	Dec.
15.3	1,794.5	93	64	100	12.3	26,403	Dec.
16.7	1,339.9	89	50	100	58.5	23,290	Dec.
4.1	5,037.7	24	49	93	248.2	60,500	Dec.
9.8	3,779.3	89	28	33	38.7	78,000	Dec.
9.6	18,065.6	79	NA	8	276.8	345,600	Dec.
5.7	2,560.6	78	59	52	−69.0	51,600	Dec.
18.4	5,526.8	30	56	86	37.4	67,000	March
8.0	6,505.0	27	58	56	489.0	84,000	Oct.
5.8	4,317.2	24	55	90	315.2	62,000	Dec.
6.9	6,624.6	25	70	29	281.6	94,022	Dec.
NA	10,504.2	100	100	4	1,341.1	232,000	Dec.
0.2	2,428.3	18	69	100	−63.3	31,000	June
7.3	8,908.7	90	NA	5	111.4	155,000	Dec.
0.3	3,679.7	11.5	82	100	−567.5	44,300	Dec.
34.7	798.6	53	42	94	−237.2	NA	June
3.7	448.1	90	41	79	87.1	107,804	Dec.
19.7	15,092.6	79	NA	2	NA	130,173	Dec.
19.7	769.7	31	NA	100	57.8	8,115	Dec.
−7.5	1,753.8	13	77	100	72.0	4,182	Sept.
−13.7	1,862.0	90	NA	13	104.0	37,533	March
87.0	234.8	98	NA	96	21.2	500	Dec.

The broader office automation market in Europe also has a number of problems to overcome. When the U.K. consultantcy, Langton, asked 360 major European companies to list their problems with OA, 36% complained they were unable to link their equipment because of deficiencies in existing systems. While the solution seems to be more applicable standards of connectivity and compatibility, 69% of those surveyed said they wouldn't wait for standards to be set before buying.

CUT DOWN WAITING TIME

European vendors and standards organizations are trying to cut down that waiting time. In 1984, European manufacturers were the first to form a Standards Promotion and Applications Group (SPAG) to support the OSI networking standard. SPAG included Siemens, ICL, Bull, Olivetti, Philips, and Ericsson. Last year, the Japanese picked up the OSI standards banner, forming their own SPAG, and the U.S. responded with the Corporation for Open Systems (COS). Many U.S. companies, including IBM, Digital, Data General, and Burroughs, are also using European sites for OSI development.

Toward the end of 1985, the European Computer Manufacturers Association (ECMA) invited IBM to contribute its LU 6.2 interface standard used in SNA to be part of an OSI recommendation to the International Standards Organization. Earlier this year, however, ECMA abandoned the idea after further study of the technical and commercial drawbacks.

X/Open, another vendor consortium, also got under way last year in Europe. The group is aimed at establishing a commercial base for Unix. Founding members Nixdorf, Siemens, Bull, ICL, Olivetti, and Philips were later joined by Ericsson, DEC, and Sperry. Part of the motivation for these standards moves is the fragmentation of the European market. Unifying the technical requirements may help to overcome some of the problems of diversity. In the past, those problems have led to the existence of more smaller companies than in the U.S. These firms are often tied to their home bases and have less competitive attitudes. Non-European vendors still dominate the Continent's information technology industry, resulting in a trade deficit of roughly Continent's information technology industry, resulting in a trade deficit of roughly $12 billion in 1985.

The picture is rosier in the telecommunications industry, where Europe ended the year with a $1.4 billion trade surplus. This, however, hides the fact that Europe's trade balance with its major competitors is worsening. Last year, Europe's telecom trade deficit with the U.S. was up 29% to $657 million, and with Japan it was up 61% to $580 million, according to Michel Carpentier, director general of the EC's Task Force on Information Technologies and Telecommunications.

European vendors are beginning to respond intelligently to these challenges and, thanks to a continued buoyancy in the market, they have the opportunity to expand. What may dim their ardor is the greater emphasis that U.S. companies are putting on European revenues in the face of stepped-up Japanese competition in a duller-than-usual home market. What DATAMATION's 1986 ranking should reveal is just how successful the Europeans have been in brightening the data processing prospects on their own home turf. ◉

C8650-1A

DATAMATION

86

OEM EDITION AUGUST 15 $3 © TECHNICAL PUBLISHING

FEDERAL COMPUTING: THE GOOD AND THE BAD

AUTOMATION IN THE WHITE HOUSE

DP DOLLARS IN SDI

PERSONAL SUPERCOMPUTERS ARE COMING

DATAMATION

AUGUST 15, 1986/$3 U.S.A.
VOLUME 32 NUMBER 16
This issue, 191,886 copies

FEATURES

50
BEHIND THE NEWS

R&D funds from the Strategic Defense Initiative won't make or break the largest individual computer recipients of government largesse. Willie Schatz reports that Star Wars may be "All Sizzle and No Steak."

62
FEDERAL COMPUTING: THE GOOD & THE BAD
Jake Kirchner

There are those who insist ENIAC is still in use somewhere deep within the recesses of the federal labyrinth. And there are those who insist that no data processing work goes on at all. Herewith, a report on the reality.

77
AUTOMATION IN THE WHITE HOUSE
Steve Ditlea

One of the Reagan presidency's most successful administrative acts has been the implementation of data and office automation at all levels of the Executive Office.

85
TRUTHS, HALF-TRUTHS, AND STATISTICS
Anne Mayfield

The news media depict large corporations as being very close to implementing totally integrated corporatewide office systems. Well, it ain't necessarily so.

NEWS IN PERSPECTIVE

FORMANCE P
RANGE IN ME
MEGAFLOPS
puters 10–40
25–100
100–1,500

26 **SUPERCOMPUTERS**
A personal version is coming. The age of integration dawns.

28 **STANDARDS**
X/Open becomes more active.

33 **OPERATING SYSTEMS**
A new OS for IBM's PC?

35 **MERGERS**
Informatics revisited.

42 **DATA COMMUNICATIONS**
Hooking dissimilar systems.

46 **BENCHMARKS**
58 **WORLDWATCH**

DEPARTMENTS

9 **LOOK AHEAD**
14 **CALENDAR**
19 **LETTERS**
23 **HARDCOPY**
91 **HARDWARE**
97 **SOFTWARE**
100 **ADVERTISERS' INDEX**

OEM SUPPLEMENT 60-1

(DOES NOT APPEAR IN ALL EDITIONS)

-2 **SELLING TO THE FEDS**

COVER ILLUSTRATION BY VICTOR JUHASZ

A federal hunger for solutions instead of hardware spells opportunity for systems integrators.

SELLING TO THE FEDS

by Anne A. Armstrong

Selling computers and information technology to Uncle Sam is either a gold mine or a black hole, depending on who the vendor is. For many years, the procurement process seemed shrouded in a mystery that only a few enlightened companies were able to solve. But a number of changes have taken place in recent years that make it easier to sell to the federal government.

In general, third-party firms are the beneficiaries of these new ways of doing business with the feds, often representing major computer and communications manufacturers or becoming acquisition targets for those hardware makers that want to enter or remain in this market.

In 1984, Congress precipitated

sweeping changes in the federal procurement process with the Competition in Contracting Act and the Small Business and Federal Procurement Competition Enhancement Act. Both bills were designed to improve the contracting process by increasing competition for the government dollar.

Although figures differ depending on what is counted, the Vienna, Va.-based market research firm, Federal Sources Inc., estimates that U.S. government spending on information technology in fiscal year 1986 will total $15.3 billion. Equipment expenses alone are expected to be some $3 billion (see Fig. 1).

A potential market that big is a powerful attraction for vendors, particularly when the commercial sector of the industry is in a down cycle. But the bidding process for a large federal contract can require the commitment of considerable money and time just to stay in the game.

"The worst thing that can happen to a vendor is to finish in second place," says John Snook, marketing manager at Falcon Micro Systems, a Bethesda, Md., company that specializes in selling to the government. "In that case, you have made a huge investment in the process and have nothing to show for it. You want to win—or get thrown out early. That's one skill the federal marketing specialist should bring to the table: knowing whether to invest resources in bidding on a particular contract."

Among the changes brought about by the new contracting laws were appeals procedures for vendors who wish to protest contract awards, and a shift away from equipment specifications in contracts to "functional specifications." With functional specifications, the government states what it wants the proposed system to do, rather than detail the hardware and software to be provided. It is up to the vendor to analyze the technology and come up with the most cost-effective solution.

In addition to competitive contracting procedures, there are several other factors that have affected the way the government buys computers. Budget reductions have continued to cut away at the ranks of government computer personnel, and directives such as the Office of Management and Budget's long-standing policy on contracting out tends to encourage, if not require, that services be moved into the

aBASE
LRESERV
STATESO
EDOL

ILLUSTRATION BY RICHARD ANDERSON

Revenues for the leading systems integrators grew 89% from fiscal year 1983 to fiscal year 1984.

private sector. In some cases, the federal government has been pressed even to find qualified technicians in the private sector to write its proposal requests and evaluate the bids that these requests elicit.

"The government is beginning to approach the bare minimum number of computer people required to operate effectively," says Robert A. Dornan, vice president of Federal Sources Inc. "The government spends one half of what private industry does on personnel."

So the government is changing the way it handles its computer purchases. In addition to putting the responsibility for system design on the vendors, in many cases, the government may also want the company to come in and run the installation once it is completed, according to Whit Dodson, a federal procurement specialist at International Data Corp.'s (IDC) Washington division.

NASA'S UNIFIED CONTRACT

An example of such an approach is a $685 million contract the National Aeronautics and Space Administration awarded to a group of suppliers headed by Rockwell International. This team of companies takes over what used to be 16 separate service contracts at the Johnson Space Center in Houston. Now the operation and maintenance of the mission control center, the software development, the central computing facility, and a collection of simulation labs are all combined into one massive service contract.

As the NASA contract indicates, the solution emerging from all the changes in contracting procedures is systems integration. The concept, which began in the aerospace industry and spread from the Department of Defense and NASA to other government agencies, is now used for most large awards. A systems integrator is often, but not always, a nonmanufacturer who selects hardware, buys software or has it written, arranges telecommunications, and combines all these components into one custom package.

The growing tendency within the government to combine telecommunications with computer contracts has hastened the trend. Distribution of the data is frequently part of the specifications. Since strictly hardware manufacturers may not have expertise in communications, they often seek other companies to join in bidding on contracts with telecommunications. More and more frequently, that partner will be a systems integrator.

IDC reports that revenues for the leading systems integrators grew 89% from fiscal year 1983 to fiscal year 1984 (see Fig. 2). Federal Sources Inc. notes, meanwhile, that systems integration within the federal government is growing at a rate of 50% per year. Estimates of the portion of the government's future computer system purchases that are candidates for systems integration bids range from one-quarter to one-half of the total.

FIG. 1

FEDERAL SPENDING ON INFORMATION TECHNOLOGY

INCLUDES COMPUTERS, TELECOMMUNICATIONS, ETC.
($ billions)

Total market		
	FY 84	12.2
	FY 85	13.8
	FY 86 (est.)	15.3
	FY 87 (est.)	16.4
Pure equipment purchases	FY 85	2.2
	FY 86 (est.)	2.7
	FY 87 (est.)	2.9
Leases		
	FY 85	1.1
	FY 86 (est.)	1.1
	FY 87 (est.)	1.1

Source: Federal Sources Inc.

FIG. 2

SELECTED SYSTEMS INTEGRATORS' FY 84 SALES TO THE GOVERNMENT

($ millions)

Computer Sciences Corp.	206
Electronic Data Systems	76
Federal Data Corp.	48
Martin Marietta Corp.	48
Planning Research Corp.	47

Source: Federal Sources Inc.

For major manufacturers and small companies alike, systems integration offers an opportunity to link up with other companies and form a team to bid on a particular contract. The systems integrator, which is the prime contractor on the job, selects the equipment believed to be most suitable for the application at hand.

Most integrators do not represent one manufacturer exclusively, but see each procurement opportunity as a new beginning for teaming agreements. "No manufacturer has a lock on new technology," says Daniel Young, president of Federal Data Corp., a Chevy Chase, Md., firm that specializes in federal systems integration. "The systems integrator needs the flexibility to search out new and better solutions."

Third parties, such as systems integrators, can be important sources of revenue to manufacturers. As part of a recent $223 million U.S. Department of Agriculture office automation contract awarded to General Motors's Electronic Data Systems unit, for example, nearly 80% of the funds ultimately will flow down to AT&T Information Systems as simple hardware buys, according to IDC.

Market analysts have estimated that Digital Equipment Corp. will receive some 15% of its total revenues from its oems selling to the government. Another 40% is expected to come from DEC acting as a subcontractor to prime contractors with federal contracts. A DEC spokesperson would not confirm those figures, saying only, "Digital is a large supplier to the government."

However, Dana Lajoie, technology development manager at DEC's government systems group in Merrimac, N.H., acknowledges that DEC will engage in more of what he calls "systemness" in order to integrate and provide more of a solution to its customers.

The shift in customer expectations is not confined to the government marketplace, says Lajoie. "Customers, in general, are expecting solutions. For years, we sold pieces and the customers are saturated with pieces. Now they want solutions, and they believe that should be the vendor's job."

Decisions to participate in a teaming agreement are made on a case-by-case basis, Lajoie adds. Among the considerations is whether the contract is something DEC would like to bid on as a prime. If the contract is primarily for computer systems, DEC would give more consideration to acting as a prime. If the project is primarily a radar system or a business communication system, then it would be more likely to go to a systems integrator. "Our business is to sell VAXs, not to act as project managers," he says.

IBM, whose equipment is included in the bids of many systems integrators, has several traditional sales units that sell to the government. It is not uncommon for a systems integrator to be bidding IBM equipment against IBM's own sales unit. Electronic Data Systems recently bid IBM equipment on a U.S. Immigration and Naturalization Services contract against an IBM division that was also bidding the company's equipment.

“Our success depends on how well the systems integrator does its job.”

IBM executives, however, have sanctioned a new corporate entity called Complex Systems Organization. The new group's purpose is to behave as much as possible like an independent systems integrator. Industry observers say the new group will not be tied to IBM equipment and regulations as completely as are other IBM sales units.

Although it is the largest computer manufacturer, IBM does not sell the most computers to the government. That distinction belongs to Sperry Corp., which, according to the General Services Administration (GSA), increased its share of the federal data processing market from 19.9% in the first half of 1985 to 23.6% by year's end. Sperry has been revamping its corporate structure to become a full-fledged systems integrator. Exactly what effect Burroughs' purchase of Sperry will have on each company in this area is not yet clear. System Development Corp., which is already owned by Burroughs, is an active systems integrator in the federal marketplace.

In the meantime, Sperry is on a roll. It bid Amdahl computers on a large Federal Aviation Administration contract and won. And the company has added another big government contract to its list, winning the bid to supply the Army with Unix-based minicomputers. For this bid, dubbed CONUS Mini, for Continental United States minicomputers, Sperry teamed with Arete Systems Group of San Jose to supply up to 1,800 Model 5000/80 minis.

Amdahl, which is Sperry's partner on the FAA contract, sees its role changing to that of subcontractor more often than not. “There's no question the government is looking for one entity to do business with,” says Jim Brunning, Amdahl's federal district manager. “Typically, our portion of the bid is not the majority, so we must be very selective about who we do business with. Our success depends on how well the systems integrator does its job.”

Brunning sees an increasingly competitive federal marketplace. “Very definitely, the environment has changed. We see many more vendors looking to the federal market, particularly third-party leasing firms.”

At the direction of Congress, federal purchasing has shifted from a heavy lease base to purchase only (see Fig. 1). Federal Data's Young says the turnaround was swift. “In 1984,” he says, “we saw 80% of the contracts go as leases and 20% as purchases. This year, so far, purchases have accounted for 85% to 90% of the contracts.”

MEDICAL
SCHOOL
EQUIVALENCY
DIPLOMA
S. Harris

CARTOON BY SIDNEY HARRIS

Other companies, such as Xerox Corp., are eager to increase their presence in the federal marketplace. Xerox has just purchased a minority stake in systems integrator Federal Data Corp. The two companies expect that FDC's expertise will permit Xerox to break into the federal market with its electronic publishing products and artificial intelligence systems.

For a company trying to move into federal sales, Falcon Micro Systems' Snook says the fastest entry is made by convincing a systems integrator to include a product on a bid. Sybase Inc. of Berkeley, Calif., which has a relational database that won't even be introduced until the third quarter of 1986, already has an agreement for TRW's Defense Products and Information Systems Groups to use the product.

MAKING SALES TO THE FED

Other ways of selling to the government include small sales (less than $50,000), which can be done by getting into GSA's schedule program. Here, vendors, their products, and their prices are preapproved by the central purchasing agency. Other federal agencies then order what they need from these schedules.

Not all firms see the government as a desirable customer, however. Officials at one small computer dealer in the suburban Washington area say they try to avoid selling to the government. “GSA takes the point of view that the government is any manufacturer's biggest dealer,” says one of the officials, “so they believe the government should get wholesale prices. But on top of that, they want handholding. Every time someone new works with a machine you sold the government, they call up and want you to tell them how to work it. You can't make any money on sales like that.

“It's a big mistake to think that if you can break even on the hardware, the agency will come back to you to buy ribbons and disks,” the dealer continues. “Supplies are sold on a separate contract to the lowest bidder. I read about all the government waste, but it's hard to find in small computer sales.”

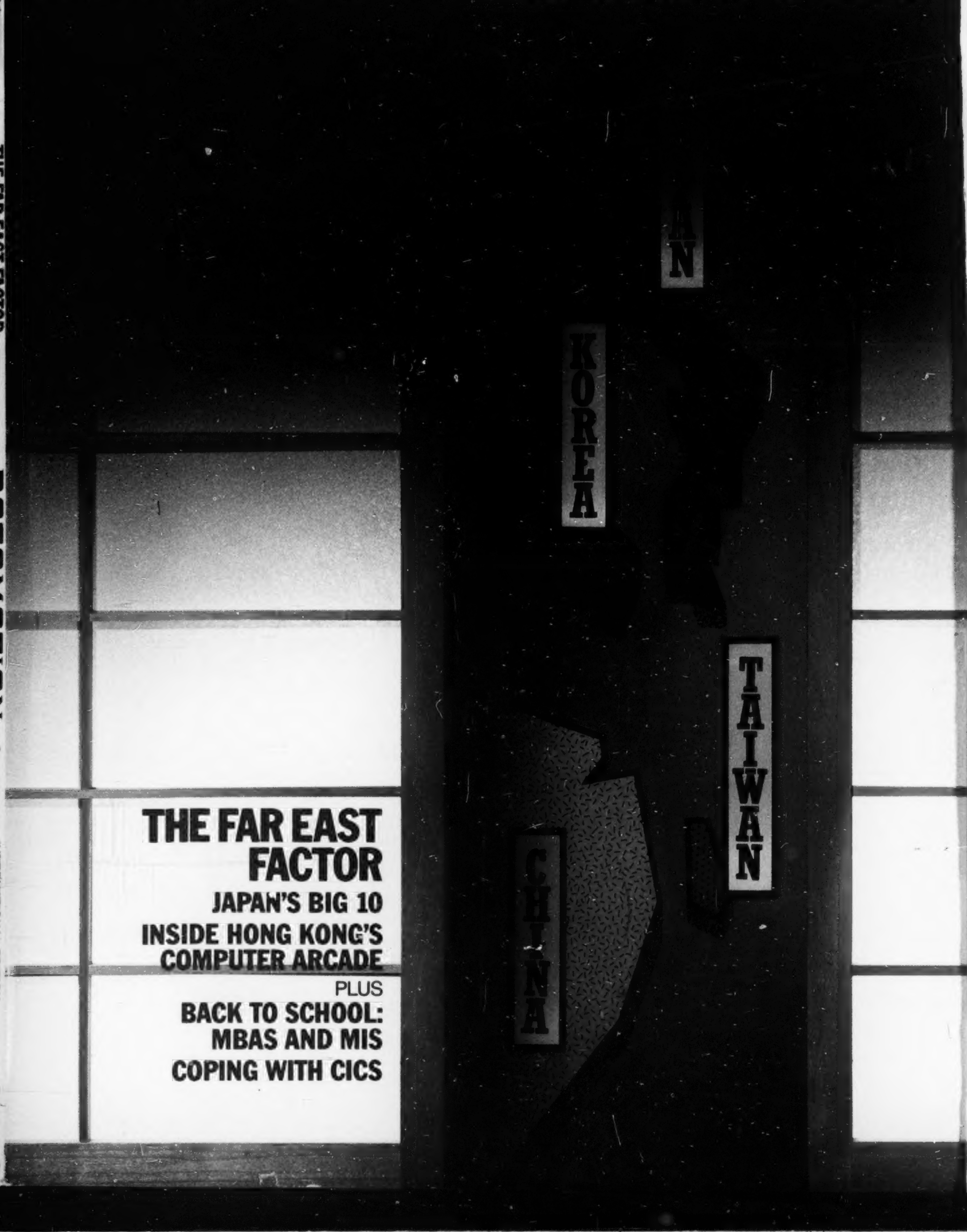
This sentiment is echoed for larger systems, as well. “The government has a lot of people who exist to make vendors jump through hoops,” says Snook. The systems integrator's job is to become an expert on hoop manuevering. ◉

Anne A. Armstrong is a free-lance writer living in Arlington, Va., and specializing in computers and related technologies.

C8650-1A

DATAMATION 86

INTERNATIONAL EDITION SEPTEMBER 1 $3 © TECHNICAL PUBLISHING



THE FAR EAST FACTOR

JAPAN'S BIG 10

INSIDE HONG KONG'S COMPUTER ARCADE

PLUS

BACK TO SCHOOL: MBAS AND MIS

COPING WITH CICS

DATAMATION

SEPTEMBER 1, 1986/$3 U.S.A.
VOLUME 32 NUMBER 17
This issue, 193,141 copies

FEATURES

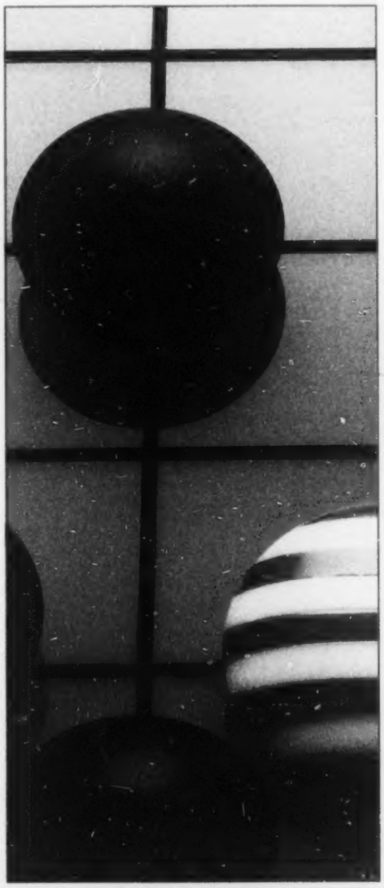
46
BEHIND THE NEWS

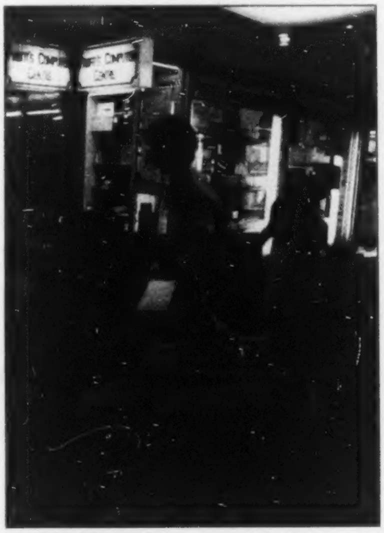
While many schools have offered at least one course in MIS for several years, the field has never received much support within the intricate political systems that constitute business school faculties. Michael Tyler asks, is "MIS for MBAs, or Vice Versa?"

60
GOING FOR JAPAN

Thomas Murtha and Linda Runyan

Japanese companies increased their presence in DATAMATION's ranking of the 10 leading dp companies in Japan by two. Approximately 84% of the combined revenues of these top 10 firms was chipped in by Japanese suppliers. These and other findings within.





71
PIRATE'S PARADISE

David Hebditch

The bargains at Hong Kong's infamous Golden Computer Arcade are certainly real enough, and so too is the country's reputation for turning a blind eye to the provenance of some of the goods sold.

77
WHAT'S AHEAD FOR CICS?

John Kador

IBM's Customer Information Control System was developed with a view to locking in users, assuring IBM dominant account control over its CICS sites. With the system approaching its third decade, the question arises: is CICS just entering its prime or is it an aging war-horse on its last legs?

84
TRAINING: THE ART OF THE SPORT

Bob Muller

Unless you can sell your internal users on a new system and its benefits, whatever marvel you have masterminded will be little more than an exercise in frustration. Herewith, a veteran developer of an effective training program describes how he did it.

NEWS IN PERSPECTIVE

22 **OPERATING SYSTEMS**
MVS/XA converts face snags.

24 **LEGAL AFFAIRS**
NCR consent decree to end.

24 **RESEARCH**
SEI ousts director.

30 **DATABASES**
CCA developing Ada DBMS.

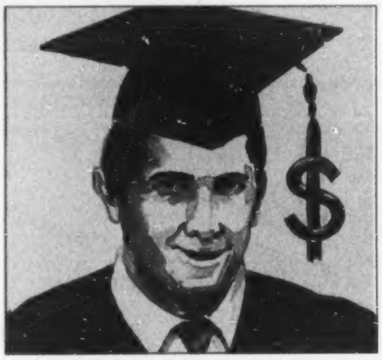
31 **MARKETING**
Infomart still not selling.

36 **PUBLISHING**
IBM enters desktop publishing.

42 **BENCHMARKS**

DEPARTMENTS

9 **LOOK AHEAD**
15 **LETTERS**
19 **EDITORIAL**



93 **PEOPLE**
97 **HARDWARE**
103 **SOFTWARE**
106 **SOURCE DATA**
108 **READERS' FORUM**
112 **ADVERTISERS' INDEX**

INTERNATIONAL 72-1

(DOES NOT APPEAR IN ALL EDITIONS)

-5 **REFOCUSING A TECHNOLOGICAL VISION**
-11 **OF TULIPS AND TRANSACTION PROCESSING**
-23 **PLAYING IT SAFE**

SPECIAL REPORT 88-A

(DOES NOT APPEAR IN ALL EDITIONS)

MANUFACTURING TECHNOLOGY/86

COVER PHOTOGRAPH BY WALTER WICK; ILLUSTRATION BY JAVIER ROMERO

LETTERS

THE LAST TIMES

Confirming points made by Frank Yang in "IBM's Big Retail Sale" (July 15, p. 46), shortly after the AT was announced, I went to the local IBM Product Center. They indicated not only that there was a backlog but that they could not even give me an anticipated delivery date. Directly across the street was an Entré computer store. They not only had an AT in stock, they delivered it, set it up, and got us running in less than three days.

A second instance of the total lack of responsiveness of the Product Center relates to ordering an electronic typewriter. Two different departments ordered IBM electronic typewriters, one from the Product Center and one from the local office supply dealer. At the Product Center, the typewriter was in a box and given to us, with all setup expected to be performed by the customer! About two weeks later, we wanted a second typewriter, ordered it from a local dealer, and, lo and behold, the dealer delivered it personally, set it up, and instructed the operator in its use.

Needless to say, those were the last times we went to an IBM Product Center.

ALFRED M. KING
Managing Director
Professional Services
National Association of Accountants
Montvale, New Jersey

MY KIND OF TOWN

"NCC at the Crossroads" (June 15, p. 169) contains the text: "What the hell were these people doing most of the time they were in Chicago?" The apparent concern of that paragraph could be expressed with: "What ever were these people doing with their time in Chicago?" This would better agree with the author's restraint of expression in the sidebar "NCC's Roots": " 'You are in deep ----,' [sic] said one IAP member bluntly . . . ."

You may want to remember that the intensive form of interrogative pronouns and adverbs is obtained by adding—and not combining—the adverb "ever." "What the hell" serves better as an interjection, e.g.: "What the hell! We'll do it anyway!"

I take it for granted that your author and former editor did not mean "What *in* Hell" which would use "Hell" as a metaphor for Chicago and might suggest the conventioners were having a hellishly good time.

DAVID AMES
Weymouth, Massachusetts

SAY WHAT?

In "Outfitting the Computer Room" (July 15, p. 58), Eric Marcus says, "Some still think the best place to locate the tape storage room is next to the tape drives. But if you send tapes off-site and the storage room is on the far side of the data center, you have to walk through the operations every time you need to send off a tape."

Say what? Let's reverse it. Everytime you mount a tape you have to walk through operations to satisfy the tape mount? I sure hope this was a misprint, because a midsized data center satisfies over 2,000 mounts a day.

I am a media management consultant who strongly recommends combining the physical tape or cartridge storage area (library) with the physical drives. The benefits:

- no loss of productivity caused by extra footsteps;
- same temperature/humidity/cleanliness with no deviation;
- same trained personnel handling the media;
- no searches for missing tapes—they are in the slot, on the drive, or in the I/O rack;
- and last, if properly managed, the recognition that *tape media are everyone's job and responsibility.*

Secondly, I am glad you indentified the need for off-site storage to back up your media. Disaster recovery plans are great, but if you don't have the data what the heck do you process? I assume you are referring to a temporary emergency vault on-site, but for your permanent off-site storage, the rule of thumb is 35 miles or a half-hour drive from the main facility. A "common" disaster, such as a fire in a multistory office building or air pollution as a result of a toxic fire would prohibit access to facilities located in the same building or immediate area.

Thirdly, I do agree that space and the work flow must be studied. Too much space means extra footsteps. Also, crts must be centralized for operator messages.

PAT RIZZIELLO
President
TLC Tape Library Consulting
Yardville, New Jersey

OVER HERE

It seems that Bert Cornelius ("Over There," Letters, July 15, p. 19) needs a lesson in world economics before he rears his part of "the next generation of Americans." Economic interdependencies are far more extensive than he, I, and proba-ble anyone really understands. Restricting ourselves to buying American products that are not competitive in the world marketplace hurts everyone in the long run for the short-term benefit of a few.

If we were to pay more for an American-made car to subsidize a relatively inefficient manufacturer, we may not have enough of our spendable income remaining to buy a cost-competitive American-made lawn mower and other things we need. Therefore, an efficient lawn mower manufacturer might go out of business to keep a noncompetitive automobile manufacturer in business. Survival of the fittest must be allowed to apply to American business or we may indeed have to learn Japanese. The only alternative is to export our labor unions and lawyers to render our competition as inefficient as ourselves.

BILL HOLMES
Libertarian
Poway, California

ADDENDUM

AGS Computers Inc., Mountainside, N.J., should have ranked in this year's DATAMATION 100. The company reports that its total 1985 revenues, all derived from dp, were $279.2 million. We regret the omission.

DATAMATION scores the game that tracks the winners and their moves in the world's second-largest dp market.

GOING FOR JAPAN

by Thomas Murtha and Linda Runyan

Making the right moves got tougher for the top players in the Japanese data processing arena last year. By coordinating their common interests, many Japanese computer companies tried to encircle competitor IBM—a typical move found in the traditional Japanese game of Go. Other firms, following the rules of cooperation, chose to join hands with Big Blue in hopes of spurring sales in certain dp sectors.

In an era of declining growth, a strategic alliance with either friend or foe can pay off. Last year the revenue payoffs accrued to the home team, as Japanese companies increased their presence in DATAMATION's ranking of the 10 leading dp companies in Japan by two. Approximately 84% of the combined revenues of these top 10 firms was chipped in by Japanese suppliers. That combined revenue total was up 14.5% to $16.4 billion in 1985. The combined revenue of 1984's top 10 showed an increase of 20% over the previous year's total.

Revenues from exports and foreign subsidiaries added another $4.1 billion to the corporate coffers of the top 10 companies. The overseas dp revenues of these firms grew 22.4% to $1.2 billion last year. Most of those revenues are derived from foreign subsidiary operations. In fact, figures from Japan's Ministry of Finance show that the country's computer exports increased a scant 1.6% to $4.6 billion, while imports shot up a substantial 31% to $1.2 billion in 1985.

The British securities firm James Capel & Co. in Tokyo estimates that the major Japanese electronics companies had moved an average of 17% of their export production offshore by the end of last year. This trend is barely visible in our own survey, which shows that roughly 20% ($4.14 billion) of the combined top 10 revenue total came from overseas production and exports—a slight increase over 1984.

Stepping up offshore activities, however, was no guarantee of profitability. The increasing strength of the yen combined with competition from the Four Dragons—Hong Kong, Singapore, Taiwan, and Korea—eroded margins for Japanese manufacturers in dp peripherals and components. This double whammy hit Fujitsu, Hitachi, and NEC hardest where it hurt the most—in their net incomes.

The yen's rapid appreciation against western currencies in late 1985 provided a strong incentive to companies seeking to increase their offshore investments. While the official OECD average exchange rates used by DATAMATION indicate a relatively constant yen-to-dollar ratio between 1984 and 1985, in reality, by the end of 1985, the dollar had lost more than 20% against the yen.

The rising yen, however, did not affect Japan's domestic dp production levels last year. Production statistics from Japan's Ministry of International Trade & Industry (MITI) reveal an 18.9% increase in the domestic output of computers and peripherals. Favorable economic conditions at home contributed to healthy, although more sluggish, growth for Japan's domestic dp industry.

THE MAJOR MOVERS ON TOP 10

The major movers in the Japanese dp market all made it onto the top 10 table. The combined revenue total of these companies accounted for a whopping 83% of the Japanese dp market, which is valued at around $19.8 billion. Most of that market went to the top four firms—Fujitsu, NEC, IBM Japan, and Hitachi—each of which stays snugly in the same position it held in 1984.

Below the fab four, there was quite a lot of repositioning, all to a lower rung. The shortest drop was taken by Toshiba, which inched down one notch to number six. The next three firms to lose ground were Mitsubishi Electric, down from number six to eight, Oki Electric, down from seven to nine, and Nippon Univac Kaisha (NUK), down from eight to 10.

The company in the cellar, NUK, pulled in $552 million in Japanese dp revenue, more than twice as much as 1984's number 10, Burroughs. In 1985, the BUNCH companies seemed to lose their punch in Japan. Both Burroughs and NCR dropped off of the 1985 top 10 table. Rushing in to fill the gap were Matsushita Electric Industrial Co. Ltd. and Nippon Telegraph & Telephone Corp. (NTT).

In making its debut in the Japan 10, Matsushita, Japan's second largest manufacturing conglomerate, won the fifth slot with consolidated dp revenues of $1.15 billion, up almost 30%. Robust oem sales of peripherals and microcomputers helped Matsushita enter the exalted ranks of the top 10. Japan's largest producer of industrial robots decided to spread its dp wings in 1985. In October, Matsushita began marketing digital PBXs in Japan. By the end of the year, the company's joint minicomputer venture with Fujitsu was paying off handsomely. The machine, produced by Matsushita and sold under the Panafacom label, had captured 7.5% of the domestic mini market.

Two notches below Matsushita is newcomer NTT. Under the terms of Japan's Telecommunications Enterprise Law, NTT became a private concern in April 1985. The former PTT's dp revenues of $762 million earned it the number seven position on the Japan 10 table.

The liberalization of Japanese telecom in 1985 spurred growth in dp services, up an estimated 21% to $7 billion. Local corporations looking for outside help in building data communications networks accounted for some of that growth. One of the major competitive drives in the local datacom market is toward providing value-added network (van) services. Nobody knows just how big this market—worth roughly $600 million in 1985—will become, but everybody knows that they want a piece of the van pie.

Both NEC and Fujitsu chalked up big gains due to rapid growth in the software and services sector. Front-runner Fujitsu, which once again outsold all its rivals in the Japanese market, earned $3.5 billion in dp revenues to easily reach the number

PHOTOGRAPH BY TOGASHI

When rivals thought they had IBM surrounded, Big Blue put them on the defensive.

DATAMATION'S JAPAN 10

1985 RANK	1984 RANK	COMPANY	OWNERSHIP	1985 JAPAN DP REV ($ MIL)	% CHG. ($ U.S.)	% CHG. (YEN)	1985 TOTAL DP REV ($ MIL)	% CHG. ($ U.S.)
1	1	**Fujitsu Ltd.**	Japan	3,528.6	12.4	12.9	4,303.5	11.9
2	2	**NEC Corp.**	Japan	2,965.3	4.3	4.8	3,753.5	13.5
3	3	**IBM Japan Ltd.**	U.S.	2,677.5	20.2	20.7	48,554.0*	9.6
4	4	**Hitachi Ltd.**	Japan	2,346.8	11.5	12.0	2,879.1	12.1
5	—	**Matsushita Electric Industry Co. Ltd.**	Japan	1,154.0	29.3	29.9	1,444.1	29.4
6	5	**Toshiba Corp.**	Japan	1,105.6	27.3	27.9	1,382.0	27.3
7	—	**Nippon Telegraph & Telephone Corp.**	Japan	762.3	20.2	20.8	762.3	20.2
8	6	**Mitsubishi Electric Corp.**	Japan	719.1	8.9	9.4	887.8	7.5
9	7	**Oki Electric Industry Co. Ltd.**	Japan	621.9	5.1	5.5	888.4	3.6
10	8	**Nippon Univac Kaisha Ltd.**	Japan/U.S.	552.2	11.2	11.7	552.2	11.2

*Includes parent company revenues

one spot. The PCM king had 12.9% growth in the domestic dp market. Overseas sales grew at a slightly slower rate of 12.4%.

One notch below Fujitsu in second place is NEC, which once again cashed in on strong sales in mainframes, telecom gear, and small business computers. These products helped NEC push its total dp revenue up 13.5% to almost $3.8 billion. Most of NEC's growth, however, was offshore. The computer and communications conglomerate racked up domestic dp sales of almost $3 billion, up only 4.3% (4.8% in yen).

STRONG GAINS FOR NEC

On the mainframe front, NEC scored strong gains in export markets through its oem arrangements with Honeywell in North America and Groupe Bull in France. Growth in overseas sales of telecom equipment and mainframes caused NEC's exports to surge 71% last year. The company, which was the first Japanese vendor to respond to IBM's 3090 announcement, rolled out the ACOS 1500 mainframe series in February 1985.

NEC's joint van venture with GE's Information Services Corp., C&C International, extended the global reach of both companies. At home, NEC struggled to maintain its local leadership position in the 16-bit microcomputer market. Embroiled in the micro melee were IBM and Fujitsu, both of which sought to nick NEC by coming out with new models and price reductions.

These micro moves proved successful. NEC's share of the local 16-bit market had fallen from 40% in 1984 to 32% by the end of 1985. Shaving that share was IBM, which scored many a sale with its successful 55XX series of workstations. IBM Japan actually shipped around 80,000 of its 5540 and 5550 workstations last year. Fujitsu also had good fortune in peddling its Facom micros, which cut into NEC's 16-bit machine market. By the end of the year IBM had won 23% of the lucrative business workstation market, while Fujitsu held 18%.

Right below NEC in third place is IBM, whose Japanese dp revenue represented roughly 16% of the combined top 10 total. IBM turned in the most impressive performance of any of the leading companies. After being badly bruised in the Japanese market in 1984, IBM marshaled its many strengths to recapture lost ground and put archrival Fujitsu back on the defensive. The company's $2.7 billion in Japanese dp revenue came on a gain of 20.7%, up from 1984's 17% rate.

Sierra shipments were the major factor in IBM's counterattack against Fujitsu during the last half of the year. In the first half of 1985, IBM had roughly a 23.2% share of the installed high-end mainframe market in Japan. Fujitsu, on the other hand, held an estimated 28.9% share in that same market—a share that was worth approximately $4.2 billion. By the end of 1985, IBM had overtaken Fujitsu, garnering an estimated 30% share.

So when IBM's Japanese competitors thought they had the company surrounded, Big Blue actually went on the offensive, putting Japan's dp dynamos on the defensive. First on that firing line was Fujitsu. The firm's delay in announcing a Sierra response certainly contributed to the resulting loss of market share. The October 1985 revelation that the two companies had gone into arbitration over allegations that Fujitsu had infringed on IBM software copyrights worsened the pcm's predicament.

Big Blue scored an even bigger coup last year when it signed a pact for 700 dp technology patents with Japan's Agency of Industrial Science & Technology. The U.S. company already has cross-licensing deals with Japan's Big Six dp makers. In one fell swoop last December, IBM had obtained access to almost all of the significant dp patents in Japan.

Living comfortably in Big Blue's shadow is fourth-place Hitachi. The hardware heavy, which posted a 12% hike in Japanese dp revenue, continued to plow the pcm path last year. That path was easier for Hitachi in 1985 than it was for fellow pcm Fujitsu. By March 1985 Hitachi had already announced its Sierra response—the M-680H mainframe. By the end of the year, the company had increased its share of the domestic mainframe market from 14% to 15.4%.

Hitachi was also up to speed on the plug-compatible peripheral front, bringing out double-density 3380 compatible 5-gigabyte disk drives right on schedule. Hitachi's PCM wizardry caught Sperry's eye. Last December the duo agreed to investigate the possibilities of collaborating on mainframe and storage-device technology.

Although Hitachi achieved healthy growth of 12% in domestic dp revenue, that gain was not enough to propel it into the league of fastest growers in Japan (Fig. 1). Heading that list is Matsushita Electric with 29.9%. In fifth place is IBM Japan with 20.7%. Companies that did not make the top 10 but nevertheless made gains were Nihon Digital Equipment Corp. with 31.1%, Nomura Computer Systems Co. Ltd. with 24.9%, Intec Corp. with 24.1%, Ricoh Co. Ltd. with 19.8%, C. Itoh and Co., with 16.4%, and Computer Services Corp., also with 16.4%.

The growth of Nomura Computer, Intec, and Computer Services is a reflection of the continuing expansion of Japan's

1985 TOTAL REV ($ MIL)	JAPAN DP REV AS % OF TOTAL DP REV	DP REV AS % OF TOTAL REV	NET INCOME ($ MIL)	1985 JAPAN EMPL	1985 TOTAL EMPL	FISCAL YEAR-END
6,550.2	82.0	65.7	234.7	70,000	74,187	Mar
9,704.8	79.0	38.7	155.8	62,712	78,389	Mar
50,056.0*	5.5	97.0	6,555.0*	16,775	405,535	Dec
20,995.7	81.5	13.7	628.6	135,000	165,000	Mar
21,174.7	80.0	6.8	1,032.6	120,412	133,963	Nov
14,101.9	80.0	7.8	270.7	110,000	114,000	Mar
20,606.0	100.0	3.7	1,372.9	314,200	314,500	Mar
8,762.0	82.2	10.1	143.7	61,870	68,745	Mar
1,676.3	70.0	53.0	19.0	17,500	18,134	Mar
552.2	100.0	100.0	21.4	4,254	4,254	Mar

FIG. 1

FASTEST GROWERS IN JAPAN

JAPAN 10 RANK	COMPANY	% CHG. (YEN)	JAPAN DP REV ($ MIL)
5	**Matsushita Electric Industry Co. Ltd.**	29.9	1,154.0
6	**Toshiba Corp.**	27.9	1,105.6
7	**Nippon Telegraph & Telephone Corp.**	20.8	762.3
3	**IBM Japan Ltd.**	20.7	2,677.5

FIG. 2

LEADING JAPANESE DP COMPANIES

		WORLDWIDE DP REV ($ MIL)	% CHG. ($ U.S.)	% CHG. (YEN)
1	**Fujitsu**	4,303.5	11.9	12.4
2	**NEC**	3,753.5	13.5	14.1
3	**Hitachi**	2,878.1	12.1	12.6
4	**Matsushita Electric**	1,444.1	29.4	30.0
5	**Toshiba**	1,382.0	27.3	27.9
6	**Oki Electric**	888.4	3.6	4.0
7	**Mitsubishi Electric**	887.8	7.5	8.0
8	**NTT**	762.3	20.2	20.3
9	**C. Itoh**	729.2	18.4	18.9
10	**Nippon Univac**	552.2	11.2	11.7

software/services sector. Ricoh, which pulled in Japanese dp revenue of $430.2 million, is trying to get a foothold in the office automation field. To get that foothold, Ricoh linked up with AT&T, which is selling the Japanese company's facsimile machines. Meanwhile, Ricoh is peddling AT&T's 3B mini and key telephones in Japan.

Making its debut in the list of leading Japanese dp companies that are ranked by worldwide dp revenues is C. Itoh & Co. Ltd. (Fig. 2). The giant trading conglomerate's Japanese revenue grew 16.4% to $202 million. C. Itoh, ranked ninth on this table, garnered $706.7 million in worldwide dp sales, putting it easily above NUK, which holds last place on this leadership list.

NUK, also in last place on the main table, nevertheless did quite well in the Japanese market last year, scoring sales of $552 million. Ironically, Sperry's Japanese sales agent ran circles around Burroughs in Japan. To get that jump on its competitors, NUK did what so many other companies in Japan did last year—it joined forces with other firms. Alliances are not new to NUK, which has had a long affiliation with the Mitsui group. Mitsui & Co. and Sperry each control 34.2% of the company, with the remaining shares held by various Japanese banks.

Prosperous partners helped Mitsubishi Electric secure positions in both the top 10 and leaders lists. In addition to oem agreements with NUK and Sperry for micros and minis, Mitsubishi Electric also signed a deal to collaborate with Rolm on digital PBXs. Toshiba, also a qualifier on both charts, forged a network of strategic linkups last year that helped boost its Japanese dp revenue to $1.1 billion. Also a member of the Mitsui companies, Toshiba was a natural to supply Nippon Univac with telecom terminal gear. Toshiba also reached out to AT&T for digital PBXs and to ITT for packet-switching equipment. The company also bought out ailing micro maker Sord Computer and took a 20% stake in Olivetti Japan.

MAJOR TELECOM TEAM-UPS

Some of the major teamups in Japan last year came on the telecom side. NTT's collaboration with IBM, announced at the end of the year, sent shock waves through the Japanese supplier community. Fujitsu and other members of NTT's vendor clique asked the Japanese Fair Trade Commission to carefully monitor the joint venture to prevent it from dominating the industry.

In an effort to put out the fire, NTT reassured Japanese firms that the main purpose of the joint venture was to develop Open Systems Interconnection (OSI) interfaces between its own Data Communications Network Architecture (DCNA) and IBM's Systems Network Architecture (SNA). That statement alone, however, was enough to cause grave concern among Japanese computer makers. The ability to interconnect to non-SNA networks in the banking, securities, and insurance industries, where NTT is strong, would greatly enhance IBM's strategic position in the Japanese market.

The furor over the decision by NTT and IBM to join forces quieted down in 1986. Nevertheless, IBM still has not been invited to join the Systems Protocol and Applications Group (SPAG) Japan, the local OSI support group. Being snubbed was easy for IBM to accept, given the fact that its

TAKEO MIURA of Hitachi thinks software is crucial to any move beyond the Blue.

TAKUMA YAMAMOTO of Fujitsu is a big believer in international cooperation.

GEORGE CONRADES, IBM Asia/Pacific, feels pcmers missed the software boat.

PLOWING THE PCM PATH

Japanese plug-compatible vendors Fujitsu and Hitachi have made a pretty good living plowing the pcm path in IBM's shadow. Weathering legal, technological, and marketplace storms, this compatible couple has made persistence pay off. But those payoffs may not be as handsome as in they were in years past. One reason is Big Blue's moves to copyrighted microcode—a strategy that's certain to stymie the pcm business. Anxious to bolster that business, the two pcm powers seem to be toeing the compatibility line while at the same time exploring the possibilities of taking new directions along the plug-compatible path.

To get a feel for the changes in the compatible cultures inside these two companies, DATAMATION interviewed Takuma Yamamoto, president of Fujitsu, and Takeo Miura, executive managing director of Hitachi's computer, telecommunications, and office systems group. Both executives were reluctant to give specific details on their pcm strategies. This reticence in talking to the press permeates the Japanese corporate world.

Asked about his company's pcm plans, Fujitsu boss Yamamoto offered this cryptic comment: "Fujitsu will not easily move away from IBM compatibility." Hitachi's Miura was more forthcoming. "We started out as an IBM mainframe producer because that was the de facto standard," he explains. "Our primary concern and responsibility is maintaining compatibility at the user level. This enables the user to continue using accumulated software assets. In this respect, our compatible strategy has not and cannot change, at least in the short term. However, when it comes to smaller computers, workstations, and artificial intelligence, we believe that there is no established IBM culture. This leaves room for us to develop our independent software strategies in these areas."

This software, which could benefit Hitachi in the international arena, will take time to develop and adapt to foreign markets. "In order to become more familiar with non-Japanese cultures, we will need an enormous manpower effort. So at the moment, this is not a major component of our overseas marketing strategy. Within 10 years, however, Hitachi will try to sell large, integrated systems incorporating our own software."

Fujitsu's Yamamoto also sees software as crucial to any move beyond the Blue. "We think our users need a nonproprietary, international standard for software. That's why Fujitsu strongly supports OSI and standards for programming languages. At present, different vendors have different options for [programming] languages. These additional specifications hinder software portability and compatibility. More standardization is needed and there's still much to be agreed upon."

Yamamoto is also a big believer in international collaboration. "Cooperation in basic technology is an essential part of our role in the worldwide dp industry," he declares. The Fujitsu chief explained the reasons the company has taken an indirect marketing approach in Europe. "When we think of opening computer stores and creating a sales force in Germany, for example, we know it would be very difficult on our own. That is one reason we have partners. Another factor is that some countries are nationalistic in their computer policies. They don't want foreign corporations to become too visible in their domestic dp industries."

The same could be said of Japan, the only market in the world that IBM does not dominate. Last year the U.S. giant was able to roll back the pcm tide in Japan, pulling ahead of both Fujitsu and Hitachi in the mainframe replacement market. In a recent interview with DATAMATION, George Conrades, managing director of IBM Asia/Pacific, offered his view of the pcm situation in Japan. "At the high end of the [computer] line, it's becoming a closer and closer race between all competitors," says Conrades. "What I think the pcms missed was that software, not the microchip, is the differentiator. In one way you can say they're in the wrong business. That's the reason so many new entrants to the market are in the software business."

So is IBM, which is adamant about protecting its software investments, especially in Asian countries that are notorious for violating copyright and patent laws. "The idea that anyone should give a concession to anyone else on intellectual property is fuzzy thinking," Conrades insists. "In the information industry, better mousetraps are delivered through better software functions. You have to have laws to protect the investor and the innovator so they can both enjoy a fair return to reinvest."

IBM denies it uses intellectual property laws to restrict user or vendor access to its software. "We'll license to anybody," claims Conrades, who went on to explain that "what we are trying to do is protect our investment from those who have not made a similar investment . . . If [pcmers] thought they could avoid this investment by doing their R&D in other ways, that was a bad business strategy. We are going to stand very strongly behind the protection of our intellectual property and so should the industry."

PHOTOGRAPHS BY KEN STRAITON

Japanese subsidiary had a banner year in 1985.

Also on the telecom front last year, NTT signed a technology transfer agreement with AT&T. By helping to ease trade tensions, it gave a major contract for core network switching equipment to Northern Telecom. During the spring of 1985, extensive negotiations over foreign telecom participation resulted in an overhaul of Japan's Byzantine system of technical standards—standards that had been tying up outside communications vendors for years.

Politicians in Washington, D.C., unsure that such streamlining schemes would do the trick, turned up the heat by urging Japan to open up its telecom market to foreign competition. Several bills calling for reciprocity of market access were offered. One Japanese response was to cut import tariffs from 4% to 6% on cpus and

Some of the major team-ups in Japan last year came on the telecom side.

peripherals, effective April 1986. This marked the removal of the last formal Japanese import restrictions on dp wares. The subsequent surge of the yen against the dollar, however, rendered this token effort virtually meaningless.

The mighty MITI continued to play a prominent role in orchestrating the development of the Japanese dp industry last year. Stealing some of MITI's thunder were vocal bureaucrats at the rival Ministry of Posts & Telecommunications (MPT). The two agencies rallied around OSI standards and the MPT proposed the formation of a high-level Telecommunications Technology Committee in response to U.S. open market demands.

Also on the standards scene, MITI kicked off a five-year project to develop Software Industrialized Generator and Maintenance Aids (SIGMA). Designed to cut down the applications software backlog in Japan, the five-year, $200 million SIGMA project calls for developing a standardized set of Japanese Unix tools for software production. Both DEC and AT&T have assumed leadership roles in SIGMA.

Meanwhile, MITI's role has changed dramatically from the days when Japan's dp industry was in its infancy. Now that the industry can stand on its own two feet, MITI officials function more as tour guides, promoters, and coordinators of projects aimed at enhancing the competitive status of the Japanese computer industry.

IBM's inroads on Japanese turf are helping to keep that competitive edge sharp. The rules of that game can no longer be dictated by any one player. To score strategic points in the year ahead, the Japanese dp masters will be looking for new patterns of play to help them battle Big Blue.

METHODOLOGY

The 1985 Japan top 10 survey was compiled exclusively by DATAMATION from information culled from our in-house database, which tracks the dp results of over 200 companies worldwide. The fiscal year of most Japanese companies ends March 31 and consolidated results are usually not announced until three to four months later. Therefore, DATAMATION has revised some of the figures in its database to reflect this more recent information. All revenue and earnings figures have also been adjusted to calendar year calculations and converted to U.S. dollars, using OECD exchange rates for the appropriate period.

For the purposes of the survey, data processing-related revenue is defined as general purpose dp products and services generated by one or more of the following categories: mainframes, minicomputers, office systems, data communications, peripherals and terminals, software and services, and maintenance and repair.

Excluded are data transmission or "basic" services revenues from specialized common carriers, standalone electronic and mag card typewriters and standalone electronic cash registers, instrumentation, semiconductors, printed circuit boards, automated test equipment, and dp supplies, with the exception of magnetic media for disk and tape drives. All peripherals that attach to a system are included. For computer-based manufacturing systems, such as computer-controlled machine tools, only computer and hardcopy output devices are included and not the tools themselves. ◉

ADVERTISING OFFICES

Francie Bolger,
Eastern Regional Sales Manager
Eastern District Managers:
John M. Gleason, Kathleen A. Murray
New York, NY 10022
875 Third Ave.
(212) 605-9400
Plymouth Meeting, PA 19462
Plymouth Plaza, Suite 201
(215) 825-4410

New England District Managers:
Ed Rappaport, Michael W. Andrea
Newton, MA 02159
199 Wells Ave.
(617) 964-3730

Southern District Manager:
Scott Schumacker
Atlanta, GA 30329
4 Executive Park Drive N.E., Suite 1205
(404) 633-5112

Midwest District Manager:
Joseph P. Gleason
Flossmoor, IL 60422
PO Box 279
(312) 381-1840

James E. Filiatrault,
Western Regional Sales Manager
Western District Managers:
Janet Engelbrecht
Mountain View, CA 94043
2680 Bayshore Frontage Rd., Suite 401
(415) 965-8222

Robert J. Rielly
Los Angeles, CA 90035
1801 S. LaCienega Blvd.
(213) 559-5111

William M. Wilshire
Irvine, CA 92715
2051 Business Center Dr., Suite 111
(714) 476-2511

Southwest District Manager
Thomas C. Rousseau
Dallas, Texas 75243
9330 LBJ Freeway, Suite 1060
(214) 644-3683

Postcard Inquiry Service/Recruitment/
Marketplace:
Shirley Stirling
(212) 605-9733
Toll Free (Outside N.Y.) (800) 223-0743

Technical Publishing
DB a company of
The Dun & Bradstreet Corporation

John K. Abely, President
Robert L. Dickson, Exec. Vice President
Edwin V. Burkholder, Senior Vice President/
Technology
Walter M. Harrington, Vice President/Finance
and Administration

Sal Massimino,
Managing Director, Europe
U.K., Scandinavia, Netherlands:
Martin Sutcliffe
France:
Michael Sales
Germany, Austria, E. Europe, Switzerland (Ger):
Uwe Kretzschmar
Technical Publishing Co.
27 Paul Street, London, EC2A 4JU, England
Tel: (44 1) 628-7030, Telex: 914911 TECPUB G

Japan:
Hiroshi Sato
IRM, Inc.
Rosei Building, 4-2,
Higashi Azabu 1-Chome,
Minato-Ku, Tokyo 106, Japan
Tel: (03) 584-1241, Telex: 242-2588 IRMTOK J

Israel:
Roseline Lewin-Wainberg
Technical Publishing Co.
68 Sokolov St.
Ramat Hasharon 47 235, Israel
Tel: 03-49 12 69

C8650-1A

OEM EDITION SEPTEMBER 15 $3 TECHNICAL PUBLISHING

SALARY SURVEY: SMALL CHANGE FOR DP PROS

THE TRUTH ABOUT NETWORK MANAGEMENT
A REVOLUTION IN REMOTE DIAGNOSTICS
THIRD-PARTY MAINTENANCE

DATAMATION

SEPTEMBER 15, 1986/$3 U.S.A.
VOLUME 32 NUMBER 18
This issue, 191,421 copies

FEATURES

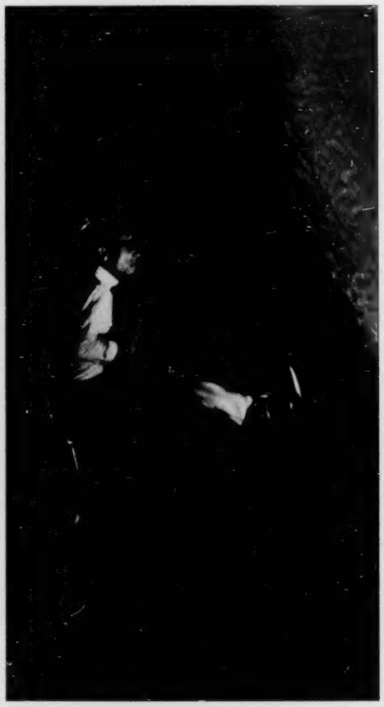
60
BEHIND THE NEWS

In the torrent of deregulation, corporations are mating madly. Ralph Emmett Carlyle answers the question on every dp manager's mind—"Mergers: A Raw Deal for MIS?"

72
SALARY SURVEY: SMALL CHANGE FOR DP PROS

Parker Hodges

Inflation is growing slowly, but so are paychecks. Systems analysis/programming managers make more than twice what their junior colleagues make. These and other findings within.



91
COMPUTER MAINTENANCE GOES ON-LINE

Omri Serlin

IBM pioneered the practical implementation of remote, on-line support. But other companies are leading the field in user self-service, computer aided dispatch, and remote console access.

98
SORTING OUT THE SOLUTIONS

Bill Musgrave

It seems that every other company in dp offers something for the network management market. Some see it from the host out, others from modems in. Here's one view.

109
SEI: THE SOFTWARE BATTLEGROUND

Edward J. Joyce

To many observers, particularly those in the computer industry, the controversy over the Software Engineering Institute's mission has nothing to do with its alleged Star Wars relationship or its military/academic mix.

121
THIRD-PARTY MAINTENANCE GROWS UP

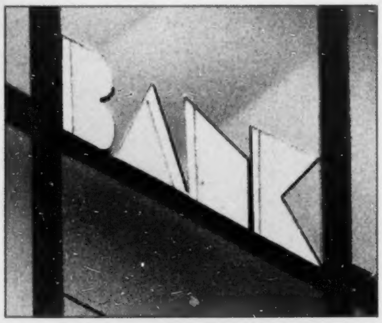
E.S. Ely

As independent servicers broaden the range of equipment they can service, large corporations are jumping over to them in record numbers. The third-party firms now account for 10% of the $13.2 billion maintenance market.

128
IS HOME BANKING FOR REAL?

Efrem Sigel

To the banks, the arguments for electronic home banking are persuasive. For the customers, however, the arguments seem less convincing.



NEWS IN PERSPECTIVE

26 **ECONOMY**
Is the industry turning up?

28 **MANAGEMENT**
Users manage in the slump.

30 **OPERATING SYSTEMS**
AT&T answers Unix critics.

33 **COMMUNICATIONS**
Rough going for Rolm.

40 **ADAPSO**
What will happen after Dreyer?

44 **INFORMATION CENTERS**
Info centers emerge slowly.

48 **TRAINING**
The disabled in programming.

56 **BENCHMARKS**
68 **WORLDWATCH**

DEPARTMENTS

9 **LOOK AHEAD**
14 **CALENDAR**
19 **LETTERS**
23 **HARDCOPY**
139 **HARDWARE**
145 **SOFTWARE**
150 **ON THE JOB**
152 **LOOKING BACK**
157 **READERS' FORUM**
160 **ADVERTISERS' INDEX**

OEM SUPPLEMENT 68-1

(DOES NOT APPEAR IN ALL EDITIONS)

-4 **BACK TO BASICS**

COVER PHOTO BY PETER ANGELO SIMON

Raises will be slimmer, but inflation's bite won't trim purchasing power.

SALARY SURVEY: SMALL CHANGE FOR DP PROS

by Parker Hodges

Times don't look good for big changes in dp salaries. Still, dp pros are optimistic about the shape of paychecks to come. With inflation at the lowest it's been since OPEC applied the first oil squeeze in 1973 (from May 1985 to May 1986 the consumer price index rose only 1.6%), DATAMATION's annual salary survey reveals that dpers expect raises averaging 6% this year. This is slightly less than they got last year: 6.2%.

But there may be a fly in the ointment. In last year's survey, those surveyed had expected their salaries to jump 7.1%; the actual 6.2% increase was 15% lower. The increase puts dp workers just about at the average for salaried employees in the U.S. According to the Department of Commerce, income from wages and salaries in the United States rose exactly 6% from 1984 to 1985. The Department of Commerce predicts that wages and salaries for 1986 will increase just 4%, which may presage disappointment for dpers expecting bigger bucks this year.

For example, according to CHI STAT, hourly earnings in computer and data processing services in March 1986 were up just 4.5% over the year before.

Other forces as well are acting to hold down salary increases. According to Sandra Shaber, an economist with Chase Econometrics, Bala Cynwyd, Pa., the cost-cutting that began in manufacturing in mid-1984 is spreading rapidly to industries that provide services. Data processing is among those industries. An even gloomier note was struck by Shaber when she told DATAMATION that in the decades immediately following World War II, conventional wisdom had it that the

Predictions are that systems analysis will be among the top 20 fastest-growing careers in the U.S.

TAMING THE INFLATION TIGER

On a percentage basis, the raises you got this year and last probably pale compared with the ones you got back in the 1970s. Yet, you've actually been doing a lot better in the five years since 1981 than you did the five years before. Thanks to dramatically lower inflation in recent years, your spending power, while not as strong as it was before 1975, is coming back.

According to the U.S. Bureau of Labor Statistics, a wage earner making $10,000 in January of 1976 would need to make $19,210.27 in 1986 to command the same purchasing clout. Put another way, the effect of cumulative inflation on salaries from January 1976 to May 1986 (the last figures available from the bureau) is 92.1%.

Had the high year-to-year inflation rates of the late 1970s continued, the results would have been astronomical. From 1976 to 1980, the annual inflation rates were 6.5% ('76), 7.7% ('77), 11.3% ('78), 13.5% ('79), and 10.4% ('80). From 1981 through May of this year, the inflation tiger has been tamed significantly: 6.1% ('81), 3.1% ('82), 4.3% ('84), 3.6% ('85), and 1.6% this year.

In DATAMATION's 1976 Salary Survey, the average salary for a vice president of MIS was $32,500. That same position reported an average of $40,700 in 1981 and $58,800 this year. From 1976 to 1981, the impact of inflation was 60% while the position's annual average salary increased only 25%. For the five years following 1981, the position's salary increased 44.5% while inflation's cumulative impact was 21%.

So if you were a typical vp of MIS in 1976 and you received raises consistent with the norm for that position, your spending power in 1981 was only 65.5% of what it was in 1976. From 1981 to 1986, the buying power of the average vp of MIS increased 23%. Overall from 1976 until May of this year, that position's purchasing power declined 11.1%.

INFLATION'S BITE THE FIVE YEARS BEFORE 1981

(IN $)

	1976 SALARY	1981 SALARY	$ GAIN	% GAIN CORR. FOR INFLATION
MANAGEMENT				
Vp MIS	32,500	40,700	8,200	−34.5
Dir. Dp/MIS	27,300	32,100	4,800	−42.4
SYSTEMS ANALYSIS				
Manager	24,900	31,500	6,600	−33.4
Sr. Systems Analyst	20,300	23,000	2,700	−46.7
APPLICATIONS PROGR.				
Manager	22,300	28,500	6,200	−32.2
Sr. Applications Progr.	17,100	23,000	5,900	−25.5
COMPUTER OPERATIONS				
Manager	18,900	23,800	4,900	−34.1
Lead Operator	14,100	15,000	900	−53.7
Operator	10,500	13,300	2,800	−33.3

INFLATION'S BITE THE FIVE YEARS AFTER 1981

(IN $)

	1976 SALARY	1981 SALARY	$ GAIN	% GAIN CORR. FOR INFLATION
MANAGEMENT				
Vp MIS	40,700	58,500	17,800	+22.7
Dir. Dp/MIS	32,100	47,900	15,800	+28.2
SYSTEMS ANALYSIS				
Manager	31,500	40,400	8,900	+7.3
Sr. Systems Analyst	23,000	36,900	13,900	+39.4
APPLICATIONS PROGR.				
Manager	28,500	41,100	12,600	+23.2
Sr. Applications Progr.	23,000	30,800	7,800	+13.0
COMPUTER OPERATIONS				
Manager	23,800	30,100	6,300	+5.5
Lead Operator	15,000	19,900	4,900	+11.7
Operator	13,300	16,700	3,400	+4.5

economy of Great Britain, moving away from manufacturing, would flourish by furnishing services.) Nevertheless, according to CBEMA, one of the dp areas still showing healthy growth is outside data processing services, with 13.3% more employees in March 1986 than in March 1985. This trend suggests that user companies are shifting some of their processing load from in-house MIS to outside contractors.

Apparently, hefty raises aren't in the cards for most Americans this year. For example, a recent study conducted by the Administrative Management Society in Willow Grove, Pa., showed that office employees are averaging just 3.2% more in 1986 than they did in 1985, down from the 4.8% increase the society's survey discovered last year.

Nevertheless, throughout this decade, unlike the late '70s, salary increases and lower inflation have given information processing pros increased purchasing power each year (see "Taming the Inflation Tiger"). For comparison's sake, the actual purchasing power of American factory workers has dropped 5% since 1978 and that of construction workers has fallen by 15%. According to Steven Greenhouse, writing in the *New York Times*, the average American household's income is 6% lower than it was in 1973, despite the rise of the two-income family.

In terms of percentage increases, the most rewarded dpers this year were people at the high end of the data entry business: in this year's survey, data entry supervisors averaged $19,708, or 11.9% over their last year's salary. Also scoring

Dp professionals in search of top salaries would do well to choose their industries carefully.

big were datacom/telecom analysts, who averaged $31,264, a raise of 10.4% over last year.

JUNIOR ANALYSTS SUFFER

Least likely to find welcome news in their paychecks were junior systems analysts: this year's average salary of $22,769 was 9.4% *lower* than last year's. Managers in systems analysis did better, but not much: their average salary of $40,353 is only $41 higher than last year. Roger O'Connor from Edward Perlin Associates in New York, a consulting firm that has surveyed dp salaries for several years, told DATAMATION that one reason for these changes might be that "fewer and fewer companies have 'standalone' systems analysts." O'Connor says that the trend is toward systems analysts/programmers. Still, the Bureau of Labor Statistics predicts that, over the next decade, systems analysis will be among the top 20 fastest-growing careers in the U.S. In 1984, the most recent year for which there are data, there were 308,000 systems analysts; in 1995, the Labor Department predicts, there will be 520,000 systems analysts, a growth of 68%.

The biggest disparity in a single area between top jobs and beginning positions is found in the systems analysis/programming area. Managers earning an average of $43,312 make more than twice the $21,504 that junior systems analysis/programmers make. These managers did better in terms of raises as well, averaging 8.7% compared with their junior colleagues' raises of 4.3%.

Not surprisingly, the more senior jobs are filled by people with longer experience in dp. For example, the average vice president of dp surveyed had 16.5 years of dp experience, more years than reported for any other job. Next in line is the director of dp/MIS with 15.7 years. Other longtime employees were managers of information centers and data centers with 14 years, managers of systems analysis/programming with 13.3 years, managers of systems analysis with 12.1 years, managers of database administration with 11.9 years, managers of operating systems programming with 11.5 years, computer operations managers with 11.3 years, managers of datacom/telecom with 10.9 years, senior systems analysts with 10.8 years, lead systems analyst/programmers with 10.2 years, managers of applications programming with 10 years, and data entry supervisors with 10 years.

Nor is it surprising that the newest recruits are to found in the junior positions, with junior systems analysts having 3.1 years of experience, junior applications programmers 2.3 years, junior systems analyst/programmers 2.1 years, and junior operating systems programmers three years on the job.

Dp professionals in search of top salaries would do well to choose their industries carefully. Across the board, dpers in the education field earn considerably less than average, in some cases less than half what their highest paid colleagues are earning. On the other hand, dpers in transportation and utilities, dp services, and nonbanking financial services consistently earn more than the average for their positions. For example, vice presidents of dp/MIS on corporate staffs in the transportation or utilities industries averaged $73,267; the same level in the education field got $48,627; and the cross-industry average was $58,466.

The importance of a current buzzword, interoperability—known less recently as connectivity—is made apparent by this year's high average salary for datacom/telecom managers in consumer manufacturing: $60,000, or 41% higher than last

DETAILED JOB DESCRIPTIONS

Respondents to the survey used this job description guide when answering the questions about their earnings.

Corporate staff: reports to senior management within corporation.

Applications programming: develops, designs, and prepares computer programs.

Systems analysis/programming: performs both systems analysis and applications programming.

Operations systems programming: programs, maintains, and introduces modifications to systems software.

Database administration: plans, organizes, and schedules the activities of the database section; establishes standards, maintains dictionary.

Datacom/telecom: develops and designs data communications networks and the installation and operation of data lines.

Computer operations: in charge of equipment, data entry, production control, and postprocessing, but not of systems analysis, applications programming, or other development functions.

Production and I/O control: sets up and schedules jobs for processing so as to maximize utilization and meet turnaround requirements.

Data entry: performs data entry and verification functions.

Office automation: operation of word processing equipment, intelligent typewriters, and terminals for text editing/word processing.

JOB LEVELS

Manager: advanced degree and minimum five years' experience or equivalent combinations; strong management skills, performs personnel evaluations, budgeting, progress reporting, and project management.

Lead: bachelor's degree or equivalent and minimum four years' experience in dp with two of those years in supervisory capacity; performs all levels of supervision as a project manager.

Senior: bachelor's degree or equivalent and minimum three years' experience including some supervisory functions.

Intermediate: bachelor's degree or equivalent and minimum two years' experience; requires direction on some activities.

Junior: two to four years' college and minimum six months' experience or equivalent combination; directly supervised.

METHODOLOGY

The 1986 DATAMATION Salary Survey began in May with a letter sent to 5,000 dp officials in the United States, drawn at random from the magazine's list of 64,000 top managers at computer sites throughout the country. Enclosed with the letter was a four-page questionnaire.

A total of 486 key officials returned completed questionnaires, providing information on salaries, benefits, and perquisites for 47 discrete dp positions in various industries and metropolitan areas.

Information was also collected on work experience, annual dp budgets, and turnover rates, among other factors. About three quarters of the respondents described themselves as dp managers. As shown in the accompanying tables, the most important labor pools covered by the survey were those in Boston, New York (divided into Manhattan and its environs), Philadelphia, Washington, D.C./Baltimore, Atlanta, Denver, Houston, Dallas/Fort Worth, Chicago, Minneapolis/St. Paul, Cleveland, Cincinnati/Columbus, Detroit, St. Louis, Seattle, San Francisco/Silicon Valley, and Los Angeles. The salary and other data were also broken down by industry category.

FIG. 1

ANNUAL SALARY INCREASES

(IN PERCENT)

	EXPECTED IN 1985	ACTUAL 1985	EXPECT IN 1986
Boston	7.9	6.4	6.0
Manhattan	9.9	6.7	8.3
NYC Metro	7.2	7.2	6.8
Philadelphia	7.4	6.7	5.9
Wash./Balt.	7.2	9.2	8.5
Atlanta	7.2	6.2	6.0
Denver	6.3	6.5	5.2
Houston	6.9	5.2	4.5
Dallas/Ft. Worth	6.4	5.8	5.6
Chicago	6.4	6.0	5.6
Minn./St. Paul	6.0	5.2	5.5
Cleveland	6.9	3.6	5.4
Cin./Columbus	6.2	7.5	6.6
Detroit	6.0	7.3	6.6
St. Louis	6.9	7.4	5.2
Seattle	4.8	4.9	6.6
San Francisco	9.6	6.8	7.2
Los Angeles	9.7	6.4	5.9
Total Sample	7.1	6.2	6.0

FIG. 2

BENEFITS AND PERQUISITES

(IN PERCENT*)

	AVAILABLE		IF AVAILABLE, TO	
	YES	NO	MGMT ONLY	MGMT & STAFF
Medical	97.3	1.6	1.9	86.6
Dental	67.3	27.4	2.1	58.6
Disability	84.6	10.9	5.8	71.0
Life Insurance	90.9	6.2	3.9	78.4
Paid Vacation	97.3	1.6	2.3	85.8
Overtime	61.3	29.6	0.4	43.4
Profit Sharing	39.9	45.7	7.8	29.4
Investment Plan	41.2	44.2	2.7	33.7
Stock Options	22.2	56.8	12.8	8.2
Stock Discount	9.1	67.5	1.4	5.8
Pension	70.0	20.4	2.5	61.5
Signing Bonus	8.2	69.1	5.3	2.3
Longevity Bonus	11.7	68.9	1.0	10.1
Club Membership	12.8	67.3	8.2	3.9
Recreational Facilities	13.6	66.7	1.9	10.3
Fitness/Health Programs	16.0	65.0	2.1	11.9

*Answers do not total 100% because of "Don't know/No answer" categories

FIG. 3

TURNOVER RATES FOR PROFESSIONAL STAFF

(IN PERCENT)

	1985 (ACTUAL)	1986 (EXPECT)
Boston	10.4	7.4
Manhattan	10.4	6.8
NYC Metro	4.7	6.1
Philadelphia	7.3	4.6
Wash./Balt.	14.7	13.7
Atlanta	5.8	4.9
Denver	10.5	11.4
Houston	2.2	2.5
Dallas/Ft. Worth	17.4	4.9
Chicago	11.1	6.6
Minn./St. Paul	9.8	4.2
Cleveland	5.7	2.3
Cin./Columbus	15.5	1.9
Detroit	6.1	6.4
St. Louis	21.5	12.8
Seattle	10.1	6.7
San Francisco	10.1	6.1
Los Angeles	10.7	7.5
Total Sample	9.4	7.1

year's average datacom/telecom manager's salary. The task of tying together the various systems serving the shop floor, inventory control, and management is growing ever more complex, particularly because of new Just-in-time manufacturing methods. But the wide range of salaries in datacom/telecom indicate that the complexity of jobs in this field varies widely.

DATAMATION's survey also confirms that economic conditions vary widely throughout the country. In the '70s, comparisons between the golden sun belt and the beleaguered North made it seem that prosperity had forever shifted to the South. But the collapse of oil prices has again rewritten the scenario. Look at turnover rates: the survey shows that in Houston, the turnover rate has plunged to only 2.2% in the shops we surveyed. Obviously, people are holding on tight to their jobs in the hard-hit capital of the energy business. In the rest of the country turnover rates hover around the 10% mark. But dp workers in Cincinnati/Columbus, Dallas/Fort Worth, and St. Louis are apparently finding new jobs more easily, sending turnover rates in these cities soaring over the 15% mark.

This movement costs money. According to Peter Tamblyn, a consultant with Edward Perlin Associates, "A 400-person data processing shop, for example, could spend as much as $2 million per year in turnover-related expenses."

THE GOOD NEWS AND THE BAD

But the survey reveals a good news/bad news dichotomy in the industry: expected turnover rates in 1986 are well below those reported for 1985. Last year, the average turnover rate was 9.6%; this year, those surveyed expect it to be 7.1%. The good news: lower costs for recruiting and training. The bad news: dp workers are not optimistic that improved economic conditions will make job moves easy. This drop in turnover rates is confirmed by another survey, one conducted by the American Electronics Association, Palo Alto. The turnover rate for 1985 was the lowest in five years. "The national turnover rate continues to fall as the electronics industry matures and consolidates," says Celeste Mahoney, AEA surveys manager.

But there is better news in some of the numbers: a few more dpers are working this year at DATAMATION's survey sites. In 1985, the total average number of employees at each surveyed site was 65.6; for 1986, the average number is 67.3. A recent survey by the Data Processing Management Asso-

FIG. 4

AVERAGE SALARY BY REGION

(IN $)

	ALL	BOSTON	MANHAT	NYC AREA	PHILA	WASH/ BALT	ATLANTA
CORPORATE STAFF							
Vice President	58,466	69,471	60,000	43,750	56,429	53,800	62,000
Director of Dp/MIS	47,974	55,916	46,600	50,733	49,893	53,582	48,854
Technical Services Manager	45,192	50,750	54,000	42,000	41,600	50,300	37,500
Information Center Manager	40,328	45,950	59,000	45,060	43,167	40,996	34,500
Director of Security	37,378	NA	NA	NA	NA	31,000	30,000
SYSTEMS ANALYSIS							
Manager	40,353	39,081	NA	29,750	46,600	45,782	34,225
Senior Systems Analyst	36,903	38,179	NA	31,667	34,500	39,878	34,000
Lead Systems Analyst	34,850	36,500	NA	NA	31,000	36,146	32,000
Systems Analyst	29,632	28,667	NA	32,000	28,267	30,063	28,931
Junior Systems Analyst	22,769	19,500	NA	NA	NA	22,000	22,000
APPLICATIONS PROGRAMMING							
Manager	41,121	39,675	40,000	NA	41,200	48,457	30,250
Lead Application Programmer	33,167	32,475	25,000	25,000	32,125	38,355	38,333
Senior Application Programmer	30,824	28,000	26,000	28,100	32,286	33,383	NA
Application Programmer	24,929	22,625	19,000	26,045	27,500	25,904	26,900
Intermediate Application Programmer	25,792	19,000	18,000	19,200	27,250	23,397	18,000
Junior Application Programmer	20,396	22,000	NA	19,000	20,400	18,407	19,653
SYSTEMS ANALYSIS/PROGRAMMING							
Manager	43,312	47,160	42,750	49,400	38,763	46,100	35,967
Lead Systems Analyst/Programmer	36,548	38,100	36,750	46,314	34,500	39,224	36,000
Senior Systems Analyst/Programmer	33,207	33,975	38,000	36,470	31,143	36,900	36,320
Systems Analyst/Programmer	29,309	29,733	41,000	30,653	26,188	34,100	33,000
Intermed. Systems Analyst/Programmer	24,961	28,300	32,000	NA	22,900	26,650	27,100
Junior Systems Analyst Programmer	21,504	22,733	22,000	25,635	17,167	22,800	21,500
OPERATING SYSTEMS PROGRAMMING							
Manager	42,848	45,950	NA	38,000	46,000	42,000	NA
Senior Systems Programmer	38,759	42,700	47,000	35,000	36,025	42,783	37,960
Intermediate Systems Programmer	30,558	37,100	NA	NA	26,575	42,000	28,300
Junior Systems Programmer	23,054	31,200	NA	NA	19,500	23,773	NA
DATABASE ADMINISTRATION							
Manager	42,046	38,600	NA	27,500	47,550	43,724	NA
Database Administrator	33,018	33,900	NA	55,000	32,000	26,667	30,000
DATACOM/TELECOM							
Manager	43,921	44,650	NA	38,000	NA	NA	NA
Analyst	31,264	41,600	NA	42,000	40,000	35,363	27,000
COMPUTER OPERATIONS							
Manager	30,087	35,010	38,333	29,832	33,922	37,955	29,875
Shift Supervisor	25,022	31,400	30,500	26,450	26,375	27,400	20,667
Lead Computer Operator	19,860	22,792	17,700	22,600	20,210	21,110	16,800
Computer Operator	16,865	18,444	17,625	18,202	17,098	17,522	15,639
Magnetic Media Librarian	16,613	NA	NA	18,000	12,000	18,000	15,000
PRODUCTION AND I/O CONTROL							
Supervisor	27,019	35,867	24,000	NA	26,000	31,467	20,000
Lead Production Controller	22,935	27,800	29,000	30,000	NA	18,000	NA
Scheduler	21,060	NA	28,000	NA	29,000	28,000	NA
Control Clerk	15,894	16,033	19,250	14,067	14,344	18,933	18,500
DATA ENTRY							
Supervisor	19,708	19,029	25,500	20,750	20,167	31,367	13,000
Operator	14,782	14,512	16,000	15,317	14,655	16,244	12,632
OFFICE AUTOMATION							
Word Processing Supervisor	25,092	29,625	40,000	NA	NA	25,000	18,000
Word Processing Operator	15,888	15,545	25,000	14,750	NA	16,000	16,000
Microcomputer User Services Specialist	22,969	20,667	27,500	25,000	29,750	20,667	20,000
DOCUMENTATION							
Specialists	22,318	19,483	NA	NA	34,000	19,805	25,000
Consultant	34,421	31,000	NA	36,000	NA	NA	26,000
Pc Evaluator	23,279	15,000	NA	NA	30,000	30,000	NA

DENVER	HOUS-TON	DALLAS	CHI	MINN/ST. PL	CLEVE	CIN/COL	DTRT	ST. LOU	SEATL	SAN FRAN	LOS ANGEL
57,314	53,750	75,000	62,500	NA	NA	57,793	62,333	71,500	47,500	51,833	64,159
51,640	56,289	51,689	42,333	39,840	46,667	43,272	54,900	47,743	47,333	53,360	51,507
38,000	45,283	48,567	46,333	45,000	50,760	37,000	54,667	54,000	50,000	32,500	47,561
NA	42,500	33,350	38,667	24,600	40,000	30,000	43,200	47,333	24,000	40,800	44,188
NA	NA	NA	NA	NA	NA	NA	NA	55,000	NA	NA	NA
42,250	46,000	40,900	44,333	26,300	43,860	NA	45,000	43,750	30,000	33,036	45,188
39,467	44,500	42,600	32,729	38,750	35,000	38,398	37,667	40,250	41,000	34,400	40,677
33,200	41,900	36,000	36,735	NA	NA	30,000	NA	26,000	28,000	42,500	39,969
33,000	38,000	29,000	32,750	25,000	33,600	NA	34,000	25,000	NA	28,000	30,684
22,000	NA	30,000	20,000	NA	NA	NA	NA	20,000	NA	NA	24,900
44,500	39,746	55,333	41,000	36,000	42,840	53,712	NA	38,000	NA	40,000	39,051
34,500	56,200	38,167	35,500	NA	30,800	NA	29,500	33,000	NA	24,000	42,500
31,500	38,875	29,575	28,000	NA	NA	34,898	29,250	31,642	NA	34,500	35,625
27,000	25,362	24,120	24,067	19,500	23,150	40,416	22,667	23,344	23,792	36,750	26,535
22,000	NA	NA	23,333	NA	32,000	36,204	NA	24,200	NA	33,250	29,000
NA	28,200	23,000	21,833	22,000	NA	32,700	18,000	16,500	21,000	26,250	20,675
42,000	47,250	30,000	40,000	45,667	33,000	39,700	54,000	43,000	NA	56,667	47,110
37,857	35,000	38,200	31,000	38,333	26,000	30,000	38,400	32,525	NA	37,290	42,258
31,000	35,250	25,000	28,500	33,750	18,000	29,449	36,363	36,275	NA	36,341	38,941
29,590	29,250	35,000	28,000	30,500	NA	29,305	30,650	27,175	26,648	33,516	34,397
27,457	25,500	26,500	21,060	23,903	14,000	36,204	24,258	21,000	NA	24,000	29,614
24,026	23,000	23,500	24,000	20,500	NA	20,000	29,000	18,800	NA	23,000	25,918
49,000	NA	35,000	37,500	46,000	NA	40,000	NA	39,000	NA	54,000	47,647
34,486	41,500	37,000	34,000	39,000	46,200	40,000	47,805	43,200	40,000	32,000	41,854
30,500	23,000	NA	NA	29,000	30,000	35,208	42,000	27,000	NA	NA	38,330
NA	NA	28,000	16,000	20,000	NA	20,000	38,000	10,400	NA	23,000	30,471
35,000	51,000	60,000	37,000	NA	45,000	NA	54,000	38,000	NA	42,500	46,970
30,806	32,000	NA	24,500	23,000	32,500	44,796	39,500	30,000	30,000	31,000	39,903
37,000	NA	30,000	NA	30,000	NA	NA	NA	60,000	NA	70,000	43,593
26,500	NA	50,000	24,360	25,000	NA	18,800	39,000	38,025	NA	40,000	31,674
32,150	39,000	26,500	27,545	26,833	24,200	33,800	28,750	30,220	36,500	27,500	35,978
26,440	26,250	23,333	17,400	23,333	15,000	33,102	24,867	19,250	21,000	28,279	26,675
21,250	20,333	21,600	19,133	19,080	17,667	16,500	20,333	18,150	24,584	21,500	21,649
16,528	18,422	17,500	16,610	15,114	16,225	17,365	19,456	15,175	18,333	18,589	19,772
NA	23,200	NA	NA	NA	17,500	NA	21,000	15,000	NA	NA	22,500
28,000	NA	28,000	17,300	NA	NA	NA	22,667	26,500	NA	40,000	25,837
22,000	NA	22,750	30,000	NA	NA	NA	22,000	NA	20,000	NA	26,076
18,500	20,000	25,000	NA	NA	NA	NA	24,000	NA	NA	NA	20,975
17,480	23,000	NA	15,625	NA	15,720	NA	15,501	15,400	NA	15,350	19,233
19,944	15,000	15,625	23,500	16,000	17,750	17,000	28,000	18,417	15,000	20,557	22,517
12,143	15,974	13,167	18,125	13,972	13,667	15,000	16,060	13,463	18,000	16,746	16,970
17,999	26,000	27,000	NA	19,781	NA	NA	NA	24,125	NA	21,500	20,674
15,652	19,550	NA	12,275	10,753	13,500	NA	15,000	16,000	18,000	22,750	16,855
NA	20,000	16,000	19,167	NA	NA	NA	34,000	28,000	NA	NA	NA
12,000	25,500	29,000	NA	28,000	22,000	NA	NA	16,100	NA	16,500	24,000
27,550	35,000	48,000	40,000	NA	45,000	24,000	NA	18,000	21,000	42,667	34,000
26,000	25,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

FIG. 5

AVERAGE SALARY BY INDUSTRY

(IN $)

	ALL	CONSUM MFG	INDUS MFG	BANK	FINAN	DP SERV	OTHER SERV
CORPORATE STAFF							
Vice President	58,466	55,600	58,750	43,563	64,182	59,614	62,600
Director of Dp/MIS	47,974	50,624	48,286	43,000	48,367	57,782	51,727
Technical Services Manager	45,192	42,356	43,076	44,850	51,020	47,667	44,500
Information Center Manager	40,328	39,364	40,307	24,600	41,700	46,667	40,333
Director of Security	37,378	42,500	38,500	NA	40,950	32,500	NA
SYSTEMS ANALYSIS							
Manager	40,353	38,400	36,738	41,250	49,200	40,345	42,000
Senior Systems Analyst	36,903	34,947	38,533	38,000	39,904	38,250	37,750
Lead Systems Analyst	34,850	33,198	36,934	NA	40,000	35,667	NA
Systems Analyst	29,632	26,613	27,934	30,000	34,825	32,667	30,000
Junior Systems Analyst	22,769	19,500	21,340	22,000	NA	21,500	25,000
APPLICATIONS PROGRAMMING							
Manager	41,121	38,759	42,728	NA	43,317	41,333	60,000
Lead Application Programmer	33,167	32,433	27,725	25,000	36,229	40,000	41,600
Senior Application Programmer	30,824	27,013	29,963	21,000	32,680	33,000	28,500
Application Programmer	24,929	25,232	25,029	20,084	26,029	28,125	24,800
Intermediate Application Programmer	25,792	21,976	27,341	NA	27,500	26,000	NA
Junior Application Programmer	20,396	16,373	22,987	NA	20,214	18,875	16,000
SYSTEMS ANALYSIS/PROGRAMMING							
Manager	43,312	42,673	39,387	NA	42,823	47,977	37,720
Lead Systems Analyst/Programmer	36,548	32,243	34,929	50,000	35,165	40,495	34,750
Senior Systems Analyst/Programmer	33,207	32,313	33,604	29,500	32,200	34,035	36,344
Systems Analyst/Programmer	29,309	27,493	30,301	28,296	29,675	30,605	26,500
Intermed. Systems Analyst/Programmer	24,961	25,660	27,823	26,000	25,684	25,489	22,500
Junior Systems Analyst/Programmer	21,504	19,300	22,436	NA	21,571	20,675	22,500
OPERATING SYSTEMS PROGRAMMING							
Manager	42,848	40,760	39,250	NA	46,593	43,000	70,000
Senior Systems Programmer	38,759	35,203	38,115	NA	37,363	42,500	50,000
Intermediate Systems Programmer	30,558	27,217	32,683	NA	31,948	35,000	27,500
Junior Systems Programmer	23,054	28,833	25,000	NA	25,275	22,000	21,000
DATABASE ADMINISTRATION							
Manager	42,046	40,928	52,000	NA	NA	41,417	NA
Database Administrator	33,018	33,843	32,328	NA	27,444	44,000	NA
DATACOM/TELECOM							
Manager	43,921	60,000	30,000	37,000	45,900	42,667	NA
Analyst	31,264	32,043	31,280	21,000	28,616	40,000	30,000
COMPUTER OPERATIONS							
Manager	30,087	31,847	29,638	21,000	32,232	30,167	31,600
Shift Supervisor	25,022	24,151	25,930	12,850	24,600	30,000	33,000
Lead Computer Operator	19,860	20,892	19,790	17,389	20,899	21,667	16,580
Computer Operator	16,865	16,692	17,395	14,480	17,537	16,800	17,109
Magnetic Media Librarian	16,613	15,375	17,500	14,000	15,667	18,500	NA
PRODUCTION AND I/O CONTROL							
Supervisor	27,019	22,500	27,375	NA	31,860	23,500	30,333
Lead Production Controller	22,935	18,993	23,125	NA	21,500	20,000	32,000
Scheduler	21,060	16,700	25,000	NA	22,000	24,000	24,000
Control Clerk	15,894	15,850	14,714	NA	17,632	18,000	16,500
DATA ENTRY							
Supervisor	19,708	21,072	17,738	9,500	23,700	23,600	20,000
Operator	14,782	14,485	15,476	9,030	15,243	15,333	15,043
OFFICE AUTOMATION							
Word Processing Supervisor	25,092	30,000	36,100	NA	23,125	22,000	19,500
Word Processing Operator	15,888	20,000	15,173	NA	16,861	16,250	15,000
Micro. User Services Specialist	22,969	25,277	24,800	NA	15,000	15,000	16,000
DOCUMENTATION							
Specialists	22,318	20,611	27,300	NA	NA	21,000	21,867
Consultant	34,421	43,034	35,000	NA	27,600	46,000	49,000
Pc Evaluator	23,279	15,000	25,000	NA	24,000	NA	23,500

DISTRB	GOVT	MED/ LEGAL	TRANS/ UTIL	EDUCA	ANNUAL SPENDING		FORTUNE CO'S
					<$1M	>$1M	
55,167	59,421	57,667	73,267	48,627	51,382	69,332	71,771
46,643	43,155	45,794	58,732	39,268	41,966	58,628	51,805
45,700	42,115	42,979	49,000	NA	39,979	47,286	46,985
36,267	39,748	38,000	45,900	32,648	36,354	43,910	45,236
NA	28,000	38,000	NA	NA	35,000	37,675	41,167
37,108	41,385	42,150	42,575	35,000	34,973	45,459	45,592
36,470	35,203	33,000	42,560	27,350	33,951	39,543	39,581
NA	34,235	41,900	NA	33,200	34,124	35,501	35,567
30,000	29,633	23,000	35,500	26,667	27,624	31,485	29,966
28,167	23,696	20,000	22,000	NA	20,509	24,592	22,500
40,000	41,370	41,133	25,000	27,500	35,685	45,824	41,743
30,250	34,014	37,300	35,100	25,500	31,240	35,414	33,176
29,750	31,133	38,375	32,075	27,213	27,895	33,481	32,528
25,282	23,369	21,251	24,700	20,367	23,066	27,459	28,109
18,633	32,359	24,000	NA	21,000	22,761	29,112	27,386
19,000	20,708	28,200	21,333	18,750	20,132	20,743	22,098
41,700	40,514	43,180	56,933	37,233	40,650	40,060	46,588
39,446	37,566	35,667	46,632	30,044	34,245	38,741	38,183
33,391	32,687	33,240	37,569	24,431	30,945	35,910	35,832
29,655	26,902	26,957	39,281	27,367	27,694	30,910	30,953
24,667	23,427	22,530	32,550	20,452	22,832	27,218	26,767
23,233	19,830	22,000	25,168	20,500	19,210	22,879	22,813
36,500	40,207	43,125	52,150	39,000	39,891	44,477	46,575
37,250	36,470	39,333	46,100	NA	32,706	40,157	39,948
33,533	29,438	30,000	37,100	21,775	27,804	32,096	32,150
20,467	22,594	20,000	24,600	15,000	18,101	24,860	26,525
40,000	40,312	29,750	47,260	NA	37,750	43,077	46,682
38,500	30,093	NA	43,300	NA	35,138	32,912	35,317
NA	40,390	NA	44,150	NA	38,000	45,698	54,060
34,333	27,424	21,500	36,063	18,720	24,816	33,199	36,041
31,753	28,694	25,011	33,156	26,517	26,104	34,123	35,041
22,980	24,412	22,167	31,057	23,000	22,077	26,517	27,416
19,496	19,939	17,261	22,242	18,114	18,544	21,459	20,791
16,230	17,091	16,084	18,060	16,267	15,976	18,261	17,997
12,500	17,590	19,100	NA	NA	14,833	17,143	17,563
25,500	24,540	20,616	52,600	NA	24,456	27,749	29,025
27,767	18,098	22,000	36,600	12,000	17,995	23,876	26,470
NA	18,546	28,000	NA	NA	18,500	21,572	21,200
11,875	16,455	15,292	18,622	15,002	14,547	16,735	17,498
16,068	18,453	18,151	25,500	19,833	16,955	23,053	22,814
13,382	14,061	14,217	17,923	12,000	14,337	15,815	15,553
NA	26,360	31,563	18,250	18,594	20,715	28,714	27,575
16,111	13,944	20,013	17,820	10,377	15,668	16,502	18,960
NA	21,139	24,167	30,000	22,333	22,965	22,973	25,716
26,900	**18,381**	**28,625**	**16,100**	**15,000**	**18,886**	**24,034**	**24,844**
36,000	**23,843**	**NA**	**NA**	**23,860**	**34,841**	**30,633**	**34,267**
NA	**21,255**	**NA**	**NA**	**NA**	**20,667**	**24,702**	**25,500**

ciation, Park Ridge, Ill., shows that 62% of U.S. corporate dp/MIS staffs are maintaining staff levels and that almost a third of all shops are currently adding staff. Half the new jobs will be for programmers, about a fourth for systems analysts, and the rest for database, information center, and telecommunications specialists. But Korn/Ferry International, a company specializing in executive placement, says that the slump in the computer industry has "depressed the demand for senior technology executives." According to the company, high-tech execs accounted for 14% of national executive hiring during the second quarter of 1986, down from 19% the year before.

Temporary employees have become much more important in the plans of the dp shops DATAMATION surveyed. Last year, the average site had used 4.8 temporary employees in 1984 and expected to use 7.1 in 1985. But this year's survey revealed that the actual number of temporary employees hired during 1985 had soared to 11.5. This year, the average site expects to hire 11.6 temporary employees. The biggest users of temporary employees are shops in Boston, Manhattan, Dallas/Fort Worth, and Cincinnati/Columbus.

The survey revealed that perks remain important in the overall scheme, with not much change in their availability from previous years. More than 90% of all dp workers are covered for medical expenses and get paid vacations and life insurance. About 85% are eligible for company disability plans. Between 60% and 70% are eligible for company pension plans, dental coverage, and overtime pay. About 40% can participate in profit sharing and/or investment plans. Much less widely available is the signing bonus for accepting a job—8.2%—and the longevity bonus for extended service—11.7%. And while fitness and health programs are everywhere in the news, they are rarer in real life, available to only 16% of the dp workers we surveyed.

The sorts of perks available can vary widely from area to area. Fitness and health programs, for example, are much more likely to be available—to between 20% and 32% of those surveyed—in Manhattan, Atlanta, Dallas/Fort Worth, and San Francisco. Recreational facilities are big in Atlanta—45%—and Seattle. And club memberships are furnished more often in Cleveland, Atlanta, and Washington, D.C./Baltimore. ◉

Reprints of all DATAMATION articles are available in quantities of 100 or more. Details may be obtained by telephoning (212) 605-9730.

A mature independent service industry now often competes head-to-head with manufacturers on quality of service.

THIRD-PARTY MAINTENANCE GROWS UP

by E.S. Ely

Third-party maintenance has long been perceived by large users as something for the little guys—cheaper perhaps, but less reliable and laden with risks that few were willing to take, including the specter of breaking ties with a valued manufacturer.

But all that is now changing. Large corporations are jumping over to third-party maintenance—which is maintenance provided by a firm that is neither the manufacturer nor the end user of the equipment it services—in record numbers, according to industry observers. Moreover, many third-party maintenance firms are broadening the range of equipment they can service—from micros, minis, and peripherals to mainframes—and thereby are becoming even more attractive to these users. Third-party firms now account for 10% of the $13.2 billion maintenance market.

"Third-party or independent maintenance has become respectable among even major corporations," says D. Roger (Mike) MacNaughton of Business Development International, a Franklin Lakes, N.J., consulting firm. He notes that the largest third-party firms (see Fig. 1) are typically owned by major corporations. Sorbus (Fraser, Pa.), owned by Bell Atlantic, is the second-largest third-party concern after TRW's Customer Service Division (Fairfield, N.J.); Sorbus reports that an increasing share of its business is from large users, and it is talking to more and more of them. "Previously, we couldn't get in the door," says Mike Chamberlain, vice president of operations.

This new respectability is clearly reflected in the industry's growth. Sales totals for independent service firms in 1985 climbed almost 17% over 1984, to $1.33 billion from $1.14 billion, according to Input Inc. of Mountain View, Calif. The growth of the independents' business outpaced that of the overall service market, which, at $13.2 billion, was up 14%. (A total of $6.1 billion was handled by IBM alone, says analyst Rebecca Segal of International Data Corp., Framingham, Mass.) Input predicts that independent service will grow 18% a year for the next five years, for sales of $3 billion in 1990, against a 17% annual growth for the overall service sector.

Such rosy predictions are a recent phenomenon for the third-party maintenance industry, which did not even exist as a business category 17 years ago. In 1969, two former IBM field engineers founded Comma Corp., perhaps the first independent firm wholly dedicated to service. (Comma was absorbed into CDC's IBM service arm in 1973.) Third-party maintenance established a foothold in the service market in the mid-'70s with the explosive growth of minicomputers and the advent of the mixed shop, which some manufacturers refused to service. By 1982, revenues had reached $570 million and were growing by 20% annually, according to New York market research firm Frost & Sullivan Inc. Then came the microcomputer boom. IBM initially left service of its PC to retailers and independents, refusing to service PCs carrying non-IBM peripherals. This left many users with no choice but to go third party (see "Who's Maintaining the Micros?" April 15, p. 82).

GROWTH SHOWS MATURITY

The current growth of third-party maintenance, say industry experts, is a measure of its dramatic maturation into a sophisticated industry that now often competes head-to-head on quality of service. At least a dozen maintenance firms have nationwide networks of service centers, with elaborate parts-tracking and delivery systems. Some even provide software support. Indeed, many service firms are actively marketing just the sort of hand-holding that users had long identified with industry leader IBM—and they're finding willing listeners.

Also pushing large users to independent maintenance are rising service costs and increasing budgetary pressures from upper management. Savings realized by replacing standard manufacturers' service with a third-party agreement average 20% but, according to several users, can run above 40% on some equipment.

Following closely behind the initial considerations of price and quality, a big draw of third-party maintenance is the promise of having one party responsible for all that can go wrong in a user's system, ending the chronic and costly finger-pointing that goes on when half a dozen vendors are on-site. "People want hand-holding," says Jim Price, founder of Pritronix, a 135-employee firm based in Dallas. "They want to know they can make one phone call and someone is going to take care of the problems."

In addition, independents will often customize service to user needs, whereas manufacturers tend to balk at service requirements outside the standard contract. That's their competitive leverage, says consultant William J. Herbert, president of Coordinated Services, Littleton, Mass. "[The independent] will say, 'I'll offer you [more than what's standard],' or 'I'll give you service outside 9 a.m. to 5 p.m. because you're this kind of operation.' "

Another advantage users find with a third-party firm is that existing service contracts become less of a factor when they are purchasing new equipment; some users feel more at liberty to look beyond their existing product bases and make purchase decisions on purely technical merits when they

FIG. 1

LEADING MAINTENANCE FIRMS

SHARE	1985 TPM REVENUES ($ MILLION)	% OF MARKET
TRW (Customer Service Division)	232	17
Sorbus	202	15
CDC (Engineering Division)	110	8
***RCA Services**	86	7
***GE Information Services Co.**	68	5

Note: Intelogic Trace, the independent service firm that was spun out of Datapoint and Mohawk Data Sciences in July 1985, reported $160 million in service revenues in 1985, at least 90% of which were derived from a six-year exclusive agreement to service Datapoint products.

*GE and RCA announced a friendly merger in December 1985.

Source: Input estimates.

THIRD-PARTY ADVICE: HOW TO SHOP

In selecting an independent service firm, common sense generally applies. Even so, a few rules come up so often in interiews with users that they seem worth repeating.

Don't shop for the lowest price. The idea is to get the best service for the dollar. Look for superior service from a firm that is willing to tailor its work to your company's needs. The most satisfied users appear to be those who passed over the lowest bidder for a firm in the middle or near the top of the bidding.

Don't be reluctant to pit manufacturer against independent to drive the price down. Manufacturers are much more anxious to deal these days. It works, says D. Roger MacNaughton of Business Development International, a Franklin Lakes, N.J., consulting firm, and "more managers ought to do it."

Don't choose a large independent with nationwide facilities just because your company is spread across a number of states. Except for users whose equipment includes a far-flung private network—in which case the advantages of a nationwide service operation are obvious—it is often better strategy to leave the selection to local managers. They can pick an independent who will serve the needs of their individual sites, who ideally will be anxious for the business, and who might well drive the price down.

When looking at the larger firms, interview the local service staff who will actually do the work. Even the largest independents, like manufacturers, have weak offices. Donald H. Bow, of Wickes Cos. Inc., Santa Monica, Calif., when considering TRW, says he reviewed the résumés and interviewed the field engineers who were to service Wickes' equipment.

Henry Hortenstine, executive vp of Lomas & Nettleton, Dallas, says that his firm chose local Pritronix over national independents despite a higher bid because L&N had already used the firm, trusted its principals, and was attracted to its wide range of customized services. The mortgage firm was installing a pc network in 110 offices around the country and Pritronix offered a complete turnkey installation and maintenance package.

Put the service firm on trial with a pilot facility. "It's time-consuming, but it's worthwhile," says one Midwest manager who tested an independent for six months before signing. "With a pilot, you make sure they produce."

Make sure the contract calls upon the independent to pay the cost of recertifying the equipment to manufacturer standards. This protects you in case the deal doesn't work out and the user has to return to the manufacturer for service.

Above all, know what you need. Users, say consultants, are so used to accepting standardized service packages from manufacturers and then grumbling about them that they have difficulty determining what services they truly need.

"Take a real good look at your operation," advises James A. Vance, vice president of processing services at Miami-based Southeast Bank, Florida's second largest bank. The bank contracts with Technical Support Services Inc. of Ossining, N.Y. "Know what you want, and go get it. The key to third-party maintenance is knowing what you need. If you know, and you have confidence in yourself, you can manage the vendor." **—E.S.E.**

needn't worry about cluttering their shops with another maintenance firm. Third-party industry leader TRW services equipment sold by 45 different manufacturers and 2,300 resellers; second-ranked Sorbus services more than 400 "brands" of different equipment. (Together, these two firms accounted for 32% of the 1985 third-party maintenance market, according to Input figures.)

Indeed, many third-party firms these days are marketing themselves as customer advocates in the often bewildering new-product marketplace, available to test and help select equipment that fits the user's needs without vendor bias. Lomas & Mettleton of Dallas, the nation's largest provider of mortgages, routinely calls Pritronix when it thinks of adding new equipment. The maintenance firm then examines the need, tests various products, and makes a recommendation. Recently, it looked into laser printers at Lomas & Mettleton's request.

Manufacturers, understandably nervous, are beginning to fight back. They are putting more effort behind marketing their maintenance, and they're working to boost efficiencies in service delivery. Maintenance is no longer perceived as a stepchild for sales, says Input senior analyst Rick Brusuelas, but a bona fide product on its own, with strong profit potentials. "Nowadays," observes BDI's MacNaughton, "manufacturers are wheeling and dealing for maintenance business that they once considered all but their right."

IBM, for example, has quietly begun to offer a so-called enterprise maintenance agreement providing a 15% discount to select customers who have agreed to put most or all of their IBM equipment on contract. The program is a direct strike at independents, IDC's Segal believes. "Most of the people who were offered the program were considering third party," says Segal. IBM has also begun to service non-IBM peripherals adapted to IBM PCs. In June, it began to offer a three-year warranty on its 3270 terminals, a move that could cripple some independents.

SERVICE QUALITY IMPROVING

These and other similar measures, along with the entry into third-party maintenance of manufacturers like Honeywell and NCR, represent a boon for users. Quality of service is improving across the board, some contend, as the bidding intensifies. "Competition is a bear, and prices are being driven down," says consultant Herbert.

Large users, in explaining their third-party decisions, often cite some level of dissatisfaction with the quality of manufacturer-provided service. Price was less of a factor, at least going into the deal.

Users commonly found that quality service was maintained for top-of-the-line processors but that manufacturers were increasingly less inclined to give quality service for smaller pieces, such as peripherals, terminals, and micros, where returns were smaller. Prices for maintenance of older equipment were being raised, in apparent efforts to sell new machines. And manufacturers openly balked at touching other manufacturers' equipment, at a time when

Third-party firms now account for 10% of the $13.2 billion maintenance market.

the large-user market was increasingly multivendor.

Illinois Central Gulf Railroad in Chicago began moving away from IBM six years ago because of dissatisfaction with terminal maintenance. "The terminal market seemed to be their lowest priority," recalls Larry T. Walsh, director of data processing. "It was not unusual to have a terminal down one or two or three days."

Initially, Walsh was concerned that IBM would respond with service cutbacks if the railroad went with a third party. Walsh says IBM personnel told him he was making a big mistake and that the third-party route couldn't offer the quality of support IBM provided. "But I weighed the lesser of the two evils and figured I've got trouble with them [IBM] now anyway." IBM's service neither declined nor improved, says Walsh.

The railroad signed with TRW in 1980. It has been so pleased that it has since awarded additional business to the firm, most recently an IBM 4341 cpu. Soon it will assign another 210 terminals to TRW. Says Walsh, "TRW's service is superior, and I don't have to deal with IBM's hierarchy."

Savings for large users can prove considerable. Walsh says maintenance costs have been cut 39% on the terminals and between 15% and 20% on other equipment. Baxter Travenol Laboratories Inc., the huge medical supplier based in Deerfield, Ill., has seen savings of between 30% and 40% on equipment it assigned to Dataserv (Hopkins, Minn.) a year ago, says Jim Bindon, operations administration manager for subsidiary Travenol Laboratories. "Being in the hospital business today, we're facing a strong cost push," he says.

Cost-cutting was the sole reason for Wickes Cos. Inc., a $4 billion diversified manufacturing and retailing concern based in Santa Monica, Calif., to switch. Wickes was pleased with IBM's maintenance, but costs were rising yearly at a disquieting 7% to 8%, recalls Donald H. Bow, director of computer management and planning. Wickes signed TRW to handle its Chicago area service, including mainframes, and Bow says it has seen substantial savi[illegible] "in excess of $500,000 a year," with service equal to or better than that from IBM.

Still, independent maintainers are a long way from securing a hold on users' large mainframe processors. A recent study by Input found that half of the users surveyed who used third-party maintenance for their large systems intended to reduce their commitment, at least for their large systems; only 25% said they planned to increase their usage. This should not come as a surprise; independents face their stiffest price competition in the large-systems arena, and few can match the sheer numbers of skilled technicians supplied by manufacturers. Input analyst Brusuelas observes that independents, as a rule, are not adept at providing the nonhardware services that large-system users take for granted: the software support, the consulting, the planning, and installation services.

BUNCH PROTECT TURF

Moreover, independents are largely precluded from servicing the newer, more sophisticated large systems. Manufacturers such as Burroughs and Honeywell, anxious to protect their turf, typically refuse to provide the full technical documentation that's needed to maintain their high-end equipment. NCR refuses to sell parts for its equipment to third-party firms. "With state-of-the-art BUNCH equipment, the user almost has to stay with the manufacturer," says consultant Herbert.

Independents can buy parts from IBM, but the technology on larger systems is so complex that it may take years for the independent to get up to speed, at a huge investment. When customers of Sorbus, which claims to be the largest maintainer of IBM equipment after IBM, require maintenance with the new Sierra series, Sorbus calls in Big Blue.

As a practical matter, the best candidates among large users for independent maintenance are those with a mixed vendor shop centered around processors that have already established their positions in the market. These users will see the largest overall savings. Manufacturers, notably IBM, are inclined to charge more for servicing older equipment. Parts for established equipment tend to be more widely available and far less expensive than parts for this year's state of the art.

The ideal third-party arrangement, of course, is one vendor overseeing the entire shop. But this is rare; only 7% of large users in a recent IDC survey had contracted cpu maintenance to a third party, reports IDC's Segal. The more common arrangement is a paired configuration, with the manufacturer handling the cpus and related equipment and the independent handling everything else. This reflects the strong hold manufacturers still have over larger equipment.

In the coming years, as the industry continues to mature, third-party maintenance will take on even more of the attributes and offerings of the manufacturers it vies to replace, analysts say. The less capable will be driven from the market, and pricing will even out as manufacturers adjust to try to keep their customers.

Most significantly, third parties will push harder into software. Software support, in many users' minds, remains the weak link for manufacturers, says Input analyst Brusuelas, and it's becoming a primary focus of concern as hardware improves. "The whole industry is moving in that direction," he says.

He sees independents setting up telephone support, problem databases, training, consulting, and documentation support, working with users all the way up to the actual software coding. But it will be slow going, he says, as they struggle with the patchwork software common to so many users. "[Software] will be a tough market to get into," says Brusuelas. ◉

"A handshake's good enough for me, Jack. This whole meeting's on videotape anyway."

CARTOON BY NICK HOBART

E.S. Ely is a Hackensack, N.J.-based business writer.

DATAMATION

OCTOBER 1, 1986/$3 U.S.A.
VOLUME 32 NUMBER 19
This issue, 193,001 copies

FEATURES

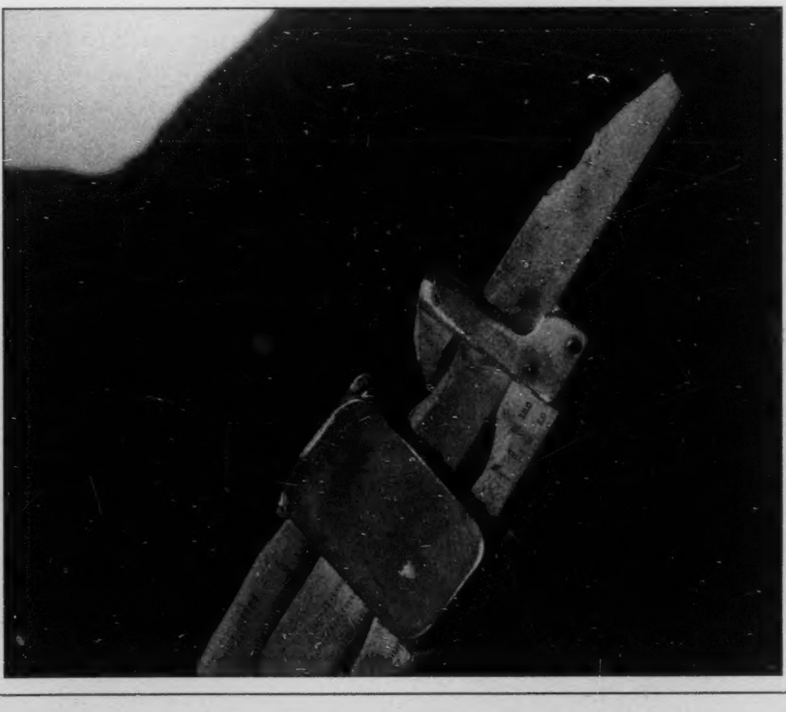
52
BEHIND THE NEWS
IBM has fostered incompatibilities to exploit and preserve its monopoly power during a period of rapid market growth and technological change. Such is economist Richard Thomas DeLamarter's view, expounded in "Square Pegs, Round Holes, Big Bucks."

70
SUPERCOMPUTING IN THE REAL WORLD
Karen Gullo
While the big machines continue to aid scientists, supercomputers will soon enter the worlds of "soft science" and MIS, where applications already require more and more computing power.

79
THE DREAM MACHINE
Edward M. Fisher
The battle to be fastest will probably continue among the conventional Cray-class supercomputers, the parallel machines, and the traditional mainframes wedded to parallelism. Whatever form the supercomputer takes, it's sure to be gobbled up by MIPS-hungry researchers.

88
FROM SLIDE RULES TO SUPERCOMPUTERS
Albert M. Erisman and Horst D. Simon
The fastest thinking machines don't yet play a major role in the curricula of science and engineering schools, but through the National Science Foundation and state initiatives, access to supercomputers has expanded enormously, and is likely to continue to grow.

99
GETTING THE DATABASE RIGHT
Robert M. Curtice
The promise of a database is its ability to share consistent and timely data throughout an organization, to enable users to access those data directly without technical assistance, and to evolve easily so that it meets changing business requirements.



NEWS IN PERSPECTIVE

22 **MAINFRAMES**
IBM's TCM causing crashes.

24 **SUPERCOMPUTERS**
Sperry enters vector market.

26 **STRATEGIES**
Convergent tries new approach.

32 **ARTIFICIAL INTELLIGENCE**
Vendors ready expert systems.
Goldman talks about AI.

43 **GRAPHICS**
Business uses come of age.

48 **BENCHMARKS**

DEPARTMENTS

9 **LOOK AHEAD**
15 **LETTERS**
19 **EDITORIAL**
109 **PEOPLE**
115 **HARDWARE**
123 **SOFTWARE**
128 **ADVERTISERS' INDEX**
128 **MARKETPLACE**

INTERNATIONAL 68-1

(DOES NOT APPEAR IN ALL EDITIONS)

-2 **COMPUTING TO CONSENSUS**
-11 **SUPPORTING THE LOCAL CULTURE**
-17 **IN THE TURING TRADITION**
-27 **BY THE RIVERS OF BABYLON**

PHOTO OF THE GREAT GALAXY IN ANDROMEDA BY CALIFORNIA INSTITUTE OF TECHNOLOGY/SPECIAL EFFECTS PHOTOGRAPHY BY PETER ANGELO SIMON

The high-tech caravan is giving Middle Eastern countries sleepless Arabian nights.

BY THE RIVERS OF BABYLON

PHOTOGRAPH BY J. PAVLOVSKY/ SYGMA

by Paul Tate

Dressed in full military uniform and flanked by a well-armed guard of red-bereted soldiers, Iraq's First Deputy Prime Minister Taha Yassin Ramadhan marched along the red carpet running down the center of the auditorium. He was about to open the Second International Baghdad Conference on Computer Technology and Applications, which was held in the Iraqi capital earlier this year. An introductory reading of the Koran still echoed in the ears of the assembled Arab delegates as Ramadhan stepped on the stage. Above him, large portraits of the country's president, Saddam Hussein, looked out onto the audience.

A couple of hundred miles to the south, beyond the hanging gardens of the ancient city of Babylon, the armies of Iraq and Iran were locked in yet another bloody battle, the latest in the six-year war that has dominated the lives of both countries. A couple of hundred miles to the north, close to the Iranian border, Iraqi troops were fighting against local rebel forces that were taking advantage of the government's vulnerability.

Somewhere in the middle, in Baghdad's well-fortified Ministry of Planning, Taha Yassin Ramadhan welcomed the audience. "The holding of this conference in Baghdad while our brave soldiers are fighting at the front is a clear indication of the emphasis that President Saddam Hussein puts on technology," he told the gathering.

Despite the war, the crumbling economy, and an acute shortage of workers, Iraq seems determined to continue its internal development. Computer technology is playing its part. "While we defend our country against the Iranian invaders, we proceed with development in all directions, including the scientific fields," stated Ramadhan.

For most of the other Arab countries represented at the Baghdad conference, coming to grips with technology is a little easier than it is for war-stricken Iraq. Nevertheless, many of the problems they face are just as difficult to overcome. The Arab world is a stark blend of the old and the new. The oil wealth, which has transformed the region into an international force in finance and world politics over the last few decades, has left its mark. The economic, political, and social structures of the Arab countries have been affected, but only in a patchy way. Many of the old traditions, religious customs, and political rivalries remain.

The climate and geography of the region means that only a small proportion of the 15,000 square miles of the Arab world is cultivated and populated. This leads to serious transport problems and poor communications infrastructures. As a result, there are massive differences between life in the cities and in the outlying regions, with all the lack of common identity and national purpose attendant upon such a contrast.

The Arab countries with oil have fared best over the last few years. With that oil wealth came development; with development has come technology. The first computer in the Middle East was brought in by the Suez Canal Authority back in the early '50s. But it was during the '70s that the Arab countries began to invest heavily in computer systems. During that decade the Middle East was the fastest-growing market in the world for dp and communications products.

Those systems came exclusively from outside suppliers, and to a large extent they still do. IBM, NCR, Burroughs, Hewlett-Packard, Britain's ICL, France's Groupe Bull, and West Germany's Siemens still have hefty slices of the Arab market. Among the up-and-coming suppliers are Japanese firms and East Germany's Robotron. Last year, the Arab world imported an estimated $300 million of computer equipment from all these sources, much of it going to Saudi Arabia, the largest market in the region (see Fig. 1).

A PETRODOLLAR PARADISE

Just as the systems came from outside the region in the '70s, so did most of the skills to develop, program, operate, and implement them. The Arab world became a petrodollar paradise for contract computer staff from Europe and the U.S.

The legacy of that rapid rise in computer usage is common to all the Arab

IRONIES IN IRAQ

The painted banner was hanging next to the entrance of the conference hotel. The large red letters were unavoidable. "Due to the sustained efforts of the revolution, the computer is at the service of all citizens," read the banner. It was the work of one of the programmers at the Iraqi National Computer Center in Baghdad. "It was my idea," he told me. "I wrote it myself. Everyone can see it there. We are proud of what we've done."

The irony was that most of the country's citizens would never see it. The foyer of an international hotel is not a common meeting place for the majority of Iraqi citizens. What's more, most of the male population between 18 and 35 years old are involved in the war effort. Egyptian laborers and craftsmen have been imported by the thousands to continue with the many flamboyant and morale-boosting construction projects in the city, while workers from the Philippines staff most of the hotels. Most suprisingly for a Middle Eastern nation, women are employed in many areas of the economy and administration. A clear case of social change bred by necessity.

What the computer does in Iraq is help the government administer the country in the midst of a devastating war. Since President Saddam Hussein seized power in 1968, Iraq has seen a steady increase in the use and development of computer technology. The war, however, with its serious economic effects over the last few years has made purchasing computer systems an erratic pastime for Iraq. Imports of computer systems and peripherals in 1985 were around $35 million. Back in 1983, they were closer to $50 million (see Fig. 2). But with inflation running as high as 50% a year, an acute shortage of foreign currency, and a war effort to support, it is not surprising that the country's buying pattern is unsteady.

Most of the users in Iraq are in government departments, the national airline, the national bank, and the armed forces. The main suppliers come from the U.S., the U.K., France, and West Germany, although recently Robotron from East Germany has established itself in the country and the Japanese are starting to make inroads too. In fact, Iraq has become the first Arab country to sign a manufacturing license with the Japanese, building NEC pcs in local factories. The Iraqis hope to finalize a similar deal with Italy's Olivetti.

That willingness to get involved with computing at the ground level has long characterized Iraq's technology policy. The National Computer Center, set up in 1972 when there were only about 10 computers in the country, has guided the use of systems in the large organizations and brought the number of large systems in Iraq to over a hundred. More important, 90% of the applications running in Iraq have been developed locally, a testament to the in-house training NCC offers.

Microcomputers have been used since 1984, and bulk orders for Arabic language pcs were placed with a number of Western suppliers in 1985. The deals with NEC and Olivetti are a product of this pc policy, which includes setting up pc training courses in schools next year.

But there's still a long way to go. The war may have made the need for automation more acute, but it has also undermined the country's purchasing power. Desperate for foreign currency, the Iraqi dinar costs $3.22 at the country's only bank, and importing currency is severely restricted. Iraq has the motivation, some of the expertise, and the ambition to be a significant force in technological development in the Arab world. What it doesn't have is the money.

"Who would want to spend time trying to sell computers here when we aren't going to pay for them for at least two years?" asked a pragmatic taxi driver on the way to the airport. On the right was another architectural wonder, dedicated to Iraq's martyrs. The morale-boosting structure had been recently completed at a cost of 40 million dinars. It cost another 11 million dinars to have all the martyrs' names inscribed in the monument in gold. Iraq is full of such ironies.

—P.T.

countries. They all need more technical expertise, many have no local technology industry, and they are all finding that they need to modify imported products to suit the local language and culture. The need for this so-called Arabization has become even greater in the wake of on-line networks and the ubiquitous personal computer that have taken the technology closer to the Arab people.

The second Baghdad conference hoped to bring some of those blurry issues into sharper focus. It had a host of sponsors, including the Iraqi National Computer Center (NCC), the Iraqi Electronics and Computer Research Center (ECRC), the Baghdad-based Economic and Social Commission for Western Asia (ESCWA), the United Nations Educational, Scientific, and Cultural Organization (UNESCO), and the Intergovernmental Bureau of Informatics (IBI), headquartered in Rome.

The first Baghdad conference was held in 1975, when the region was beginning to catch on to computing. Over a decade later, the second conference discussed an Arab world that has caught on and wants to plan its next moves.

In the Iraqi NCC building, complete with its own armed guard in a suburb of Baghdad, 400 delegates from 25 countries, including East Germany and Japan, spent three days investigating applications, technologies, strategies, and regional issues. Applications in the oil business, medicine, education, and water control were foremost among the application areas. Microcomputers, pattern processing, and management information systems were the hot technology topics.

There was also the odd historical reference. "Iraq and the rest of the Arab world need no reminder of the importance of science and technology," said Nasim Ahmed, former federal secretary of information in Pakistan. "If it were not for the Arabic numerals, and notably the introduction of zero, we would not be discussing computer technology today."

That was a long time ago. Today the Arab world is lagging behind the main industrialized countries in its development and use of technology. That is reflected in the three main recommendations from the conference.

- The Arab world needs to increase its use of microcomputers, particularly in education.
- Regular conferences and workshops should be set up to help disseminate expertise in developing and applying technology.
- Local independence should be achieved through the "Arabization of computer language."

Emphasizing Arabic language in automation is seen as an essential forerunner of widespread computer use in the region. There are already a number of bilingual software packages available, but too few by far, according to local users. A lot of work is going into Arabic linguistics, but the research is fragmented and the results are sometimes contradictory.

A WHOLE DIFFERENT APPROACH

It is not just that the Arabic characters are different from the standard Western letters and symbols; the whole approach to the written language is different. At the University of Kuwait, researcher Fatma AlKhalifa has been working with Nabil Ali of Al-Alamiah Software on a study of the differences between English and Arabic in computing. "In a way, Arabic and English represent the two extremes of computational diversity," says AlKhalifa.

Linguistically, they are strangers. In computing terms the differences affect the keyboard layout, the display controls, error detection and correction, database organization and text retrieval, to name but a few areas. There are also problems with data security, since encryption is heavily based on text compression, and new algorithms are needed for Arabic text. For the local

FIG. 1

DP IMPORTS TO SAUDI ARABIA
($ THOUSANDS)

	FIRST HALF 1985	FIRST HALF 1984
France	7,474	1,674
W. Germany	4,392	4,377
Italy	140	732
Japan	4,225	1,668
U.K.	9,614	8,817
U.S.	33,041	41,390
Scandinavia	759	3,437
Others	2,978	13,234
Total	62,623	75,329

Source: Middle East Computing

FIG. 2

DP IMPORTS TO IRAQ
($ THOUSANDS)

	1984	1983
France	2,735	19,185
W. Germany	865	4,282
Italy	3,583	48
Japan	4,615	14,914
U.K.	1,953	2,660
U.S.	2,891	1,228
Scandinavia	49	84
Others	475	682
Total	17,166	43,083

Source: Middle East Computing

computer user, that all makes life uncomfortably difficult. For the Arabic language software developer, it makes it challenging.

"The Arabic language is spoken by over 150 million people," explains A. Mouradi from the Moroccan Faculty of Sciences, "but it has not been studied in depth in terms of the user interface. Little work has also been done about Arabic speech, both in synthesis and recognition." Mouradi has started to do something about that. In a project at the Moroccan Faculty, he has developed some linguistic rules covering the conversion of Arab text to speech. One practical early result is an Arabic equivalent of Texas Instruments' Touch and Tell game.

On a more serious level, Arabic programming languages are starting to emerge. The Arabic Computer Language (ACL) being developed by M. Sharif and H. Nasser in Iraq and the DHAD language of M. El-Khayat from the Saudi Arabian Petrol and Minerals University in Dahran are both subsets of Pascal. The first is an educational and training language while the second is aimed at defining data models.

Some progress has already been made in having Arabic acknowledged as an international standard in computing. The Arab Organization for Standardization and Metrology (ASMO) in Amman, Jordan, submitted a draft standard to the International Standards Organization for an Arabic code table in 1985 and after amendments it was accepted. ASMO 449-1985, as the original proposal was called, should help to regulate the way Arabic is used in processing and information interchange.

"The standardization of Arabic information processing is not a simple task, and technology advances quicker than we think," says Ahmad Abu-El-Haija from the Yarmouk University in Jordan. "It's hoped that Arab experts, manufacturers, research institutes, universities, and interested organizations will collaborate on other important issues in this field. That is what makes a standard."

The conference recommended a number of steps that may help achieve such a level of cooperation. Special courses should be organized that will bring together computer experts and Arabic language experts to work on the Arabization of computer language. Research centers in Arab countries and Arab researchers in foreign universities should direct their work to using the language in programming and to developing devices suited to Arabic. Language labs in the Arab countries should be asked to set up computer projects. Computer suppliers should be asked to increase their research into Arabic systems if they want to increase sales. And finally, national and regional projects must be coordinated.

NEED TO COMBINE EFFORTS

That call for Arabic collaboration ran through many discussions. "Activities in Arabization are scattered around the Arab world," explained Yousif Nassir, the director of computers systems at the Royal Scientific Society in Jordan. "We need to combine our efforts to achieve results."

That was also the consensus of the Arab Regional Meeting on Informatics held by the IBI at the same time as the Baghdad conference. The representatives from eight major Arab countries decided that it was about time the League of Arab States had a department responsible for informatics and its local coordination. So far the league has not responded.

The Arab League is the largest coordinating body in the region. Set up in 1944 by the so-called Alexandria Declaration, it now comprises over 20 Arab nations and aims to foster close relations between its members.

On the computer side it has set up a number of departments covering natural sciences, documentation and information, communication, and Arabization. But many members of the computer fraternity don't regard its activities very highly.

"The trouble with the whole region is the politics," confided one Kuwait representative, educated in computer science in California and now back home working at the Kuwait Ministry of Planning. "That's why it's so much trouble to get countries to work together."

The often unstable political climate in the Middle East "overshadows the work of the Arab League's technical organizations and enormously complicates and hampers any cooperative work within the Arab world," asserts Michael Agi, a Syrian researcher currently working at the West German research institute GMD.

Agi's recent book, *Dataprocessing and Telecommunications in the Arab World* (published independently by G. Agi, Koenigswinter, West Germany, 1986), paints a detailed picture of computer and communications development in the region, and he devotes a chapter to the need for greater Arabization. As technology progresses, "the widespread use of English-based systems will be prohibited by language problems, since more and more employees with insufficient knowledge of foreign languages will be involved in using technology," predicts Agi.

That is not only undesirable for anyone trying to increase computer usage in the region, it is also undesirable from a cultural point of view. "Are we going to let our cultures be dominated by other cultures or are we going to participate?" demanded Jordan's Nasser.

So much for rhetoric. What about a time frame for achieving the aims set out by the Baghdad conference? "We are confident that something will happen now," concluded Nazar Al-Najran, a young technical support manager from Kuwait, one of the new breed of computer-wise government officials that attended the conference. "The countries involved recognize how important these technologies are and that they must work together to get the best out of them for the Arab world."

Perhaps the Arabization moves that are now under way will help that new breed achieve its technological goals. It may also help to overcome the prohibiting effects of some Arabic traditions. Pakistan's Ahmed sums the feeling up nicely: "We hear a good deal about fundamentalists today. To my way of thinking, many of these fundamentalists have their backs to the future. To face our future, we have to grasp the fundamentals of the present age." ⊛

10/24/86 C8650-1 A

DATAMATION 86

OEM EDITION OCTOBER 15 $3 TECHNICAL PUBLISHING

MIS IN THE CORPORATE JUNGLE

PLUS

THE TRUTH ABOUT CONTRACT PROGRAMMERS

ADAPSO'S 25TH ANNIVERSARY

DP AT THE CENTERS FOR DISEASE CONTROL

DATAMATION

OCTOBER 15, 1986/$3 U.S.A.
VOLUME 32 NUMBER 20
This issue, 191,676 copies

FEATURES

66
BEHIND THE NEWS
ADAPSO is on the cusp of a host of new philosophic, organizational, and practical challenges as it enters its second quarter of a century. It is "Coming of Age," reports David R. Brousell.

82
BATTLING FOR NEW ROLES
Connie Winkler
No matter what their rank or official title, the top management information systems executives in many large corporations today are in the midst of an identity crisis—unsure which tactic to employ, which role to play, which hill to attack.

93
BORDER PATROL
Parker Hodges
News from the front lines of MIS: 50 dpers from the 100 largest users in the U.S. report on their place in the corporation in DATAMATION's latest survey.

99
IS ANYONE REALLY USING COMPUTER CONSULTANTS?
David Stamps
What do you get when you put two unemployed computer programmers together? A consulting firm, of course. Is the humor at the expense of consultants or of those who hire them?

107
MILESTONE MANAGEMENT
Frank Sweet
It is possible to make and meet accurate delivery dates. All it takes is four simple steps: understand the goal, define it, communicate it, and measure performance against it.

124
OTIS TO THE RESCUE
Esther Surden
After decades of decentralization and disarray, New Jersey's Office of Telecommunications and Information Systems is doing a commendable job of bringing its disparate systems under centralized management.

131
RAPID PROTOTYPING REVISITED
Daniel E. Klingler
If you're considering any of the numerous, often conflicting versions of rapid prototyping approaches, you should look before you leap. Here's a five-step process to keep you from stumbling.

136
TRACKING AMERICA'S HEALTH
Gail Gregg
The decentralized computer operation of the Centers for Disease Control is finally being given some direction from the top.

NEWS IN PERSPECTIVE

26 **SOFTWARE**
Cullinet's new strategy.

28 **LANGUAGES**
Vector compilers merge.

32 **WORKSTATIONS**
Windowing standards battle.

34 **STANDARDS**
MAP hits a delay.

43 **MERGERS**
Wells, Crocker merge dp.

46 **MICROCOMPUTERS**
Compaq's 386 gamble.

55 **STRATEGIES**
P&G invests in Metaphor.

62 **BENCHMARKS**
76 **WORLDWATCH**

DEPARTMENTS

9 **LOOK AHEAD**
14 **CALENDAR**
19 **LETTERS**
23 **HARDCOPY**
145 **HARDWARE**
151 **SOFTWARE**
156 **LOOKING BACK**
161 **READERS' FORUM**
164 **MARKETPLACE**
172 **ADVERTISERS' INDEX**

OEM SUPPLEMENT 80-1

(DOES NOT APPEAR IN ALL EDITIONS)

- 1 **WHY COMDEX?**
-9 **THE TECH WORKSTATION MARKET**

COVER PHOTOGRAPH BY WALTER WICK;
3-D ILLUSTRATION BY KATHY JEFFERS

Oems, move over. Increasingly, hardware will be sold by microcomputer distributors.

THE TECH WORKSTATION MARKET

by Lamont Wood

It is slumping, yet analysts see a rosy future. There's healthy growth, but there's been a shakeout. Three fourths of the hardware is sold through oems and new niche markets continue to evolve, but downward price spirals may make new sales channels necessary. And while the hardware undeniably makes professionals more productive, increased productivity can throw a monkey wrench into an organization's established work patterns.

"It" is the engineering/technical workstation market. Outsiders probably think of this field as computer aided design/computer aided manufacturing (CAD/CAM) terminals—and, reportedly, two thirds of the hardware is sold for CAD use. But computer aided software engineering, computer integrated manufacturing, circuit board and electronic design automation, computer aided publishing, and a host of other applications are adopting the "platforms" offered by this market.

"The workstation market is doing fairly well," notes David Burdick, head of the CAD/CAM marketing service at Dataquest Inc. in San Jose. "It experienced 100% growth between 1984 and 1985, and maybe 60% this year, so it's still pretty healthy. At the same time, it's almost a shakeout situation in that the hardware has become nearly a commodity item and it's dominated by sizable companies. The stakes to get in are too high, so there will be no new major players."

Dataquest estimates that the market amounted to $929 million in 1985 and will expand to $1.5 billion in 1986 and $4.5 billion in 1990—a 37% annual growth rate.

Not everyone agrees with these figures, however. Charles Foundyller, president of Daratech Inc. in Cambridge, Mass., believes present growth is more like 15% to 20%, "a little bit better than the computer market as a whole." Bill Green, channel marketing manager at Apollo Computer Inc. in Chelmsford, Mass., puts present market growth in the 20% to 30% range, down from last year's 40% to 60% range.

There is general agreement, though, that if sales are healthy, it would have a great deal to do with technical advances in the market and customer reaction to them.

"Growth has been fueled by the transition from shared logic to distributed systems," says Burdick. "New power is being installed in the form of distributed logic workstations rather than shared logic mainframes."

The main reason that new power is being installed is that it is so much cheaper than it used to be, says Mike Gallup, director of product marketing at Apollo. "Hardware that now costs under $20,000 would have cost $75,000 only three years ago," he notes. "We anticipate prices going down 15% yearly. Black-and-white systems are now available for under $10,000, and color systems are available for under $20,000.

"With the lower prices, and with engineering workstations having become a proven concept, companies are planning on installing exponentially more boxes—getting 10 where they would have gotten two," says Gallup. Before, "the workstations were used for only the most sophisticated applications, but now they are used for technical documentation and for computer aided software engineering—two cost-sensitive markets."

And while prices are falling, performance is rising. "Today, workstation performance is rapidly approaching the midrange of superminis and may exceed it in the next 18 months," says Peter Hamilton, division manager of Hewlett-Packard's Fort Collins, Colo., Systems Division.

32-BIT MACHINES TYPICAL

Typically, engineering/technical workstations today are 32-bit machines, usually based on Motorola's 68000 chip and running Unix with a million-pixel display to support fancy graphics and virtual memory to accommodate large, complex programs.

"Fifteen to 19-inch, high-resolution color graphics are a must nowadays for even rudimentary drafting," says Apollo's Green. "A hundred megabytes of mass storage seems to be required. And you need networking and the ability to talk to [IBM] PCs and [Digital Equipment Corp.] VAXs. A hardware manufacturer has to have all that to be successful."

So, which are the manufacturers, that, according to Burdick, sell 75% of their output through oem channels, in this growing, almost $1 billion market? And what are they doing for oems?

"It looks like a battle between Sun [Microsystems Inc. of Mountain View, Calif.], Apollo, and DEC, with Hewlett-Packard and AT&T playing catch up," says Foundyller.

Dataquest's figures (see Fig. 1) show the first four players mentioned by Foundyller controlling 77% of the market—although HP does fine in second place, and AT&T is nowhere to be seen. "AT&T is down in the noise level," Burdick says.

As for how these companies got to the top of the chart, "the main thing is to have a broad range of products, not just a medium machine and a slow machine," Foundyller explains. "Sun and Apollo have a full line; you can move up in small steps, and the oem can get a substantial discount. DEC is not as strong in graphics and is conservative in pricing, but it appeals to those with VAX software. With DEC you can go from top to bottom without much reprogramming," he notes.

Oems asked by DATAMATION why they chose their vendor were reluctant to name names. Many indicate they selected brand leaders at the time and have since stuck with them. Others mention Unix as a factor, as well as quality and service. Price points seem to have little to do with it.

Apollo. If Apollo is the market leader, explains Green, "it's because we came to market with graphics, a cpu, and a distributed operating system that hit the market at the right time. We were able to win some oem contracts from firms that later grew into big players."

Currently, Apollo's primary offering is its new Domain Series 3000, starting at $9,900 for a monochrome workstation, Unix, 2MB of RAM, but no disk—or $14,900 for the same thing with color. In the $30,000 to $45,000 range, there are a series of High-Performance Color Computational Nodes, and also some high-performance workstations priced to $69,000. Apollo also has a family of network file processors with prices from $9,750 to $67,000.

Green says that about half of Apollo's hardware is sold through oems, and the

Healthy sales are the result of technical advances.

company hopes to continue to attract oems in order to keep it that way. "We are still recruiting oems and have a number of support programs—we view a design award as a coveted prize," he says. "We've got Unix, both the Berkeley and Bell versions, so a new oem can hire the best talent and get to work sooner. We have the IBM PC AT bus, Multibus, VME bus, [and so on], and our 68000 lines are strong.

"We offer a very flexible business posture," he adds. "We don't hold a gun to oems' heads to make sales. There are no contractual milestones during the development period. You get a 33% discount for the development systems. After that we offer a proactive discount, based on your business plan [and] strategy. A typical plan is $2 million for the first 12 months. For that, you get a 29% discount. We let it run until the eighth month and then adjust it for the rest of the term, not looking back. And if you make a big sale, you can apply for a higher number at any time."

He also mentions special training programs, system documentation, and support staffs to back up oems. "We have special diagnostics so you need only our kernel and can use other hardware for storage and graphics—a new policy, by the way."

Apollo's sales force also will bring in oems when calling on a customer. "If the customer picks the oem, our sales rep gets a commission," Green says.

MODEST SUN HAS "THE BEST"

Sun. Rob Cuhling, director of design automation marketing at Sun, is not modest about Sun's operations. "We have the best Unix, the best networking, and the best way of dealing with PCs," he says. "We also have the best software engineering environment—about 35% to 40% of our market is for computer aided software engineering, and 30% for CAD."

Sun offers its Sun-3 line, starting at $7,900 for the Sun-3/50 monochrome workstation with 4MB of memory. Its new Sun-3/200 series of workstations and file servers is based on a 25MHz 68020, said to offer 4MIPS performance, and can be configured from a standalone machine to a 48-terminal supermini. Entry price for the Sun-3/200 line is $35,900 for standalone (Ethernet node) monochrome with 8MB of RAM but no disk, or $46,900 for color. With less speed and memory (16.67MHz and 4MB of RAM), the entry-level Sun-3/110 color workstation costs $15,900.

Sun emphasizes its coprocessor board, which lets its platforms run software for the IBM AT, and also touts its Network File System, which allows transfer of files between dissimilar hardware on an Ethernet network, independent of the operating system. Cuhling says the Network File System has been adopted by 60 vendors, "and is the most significant standard in communications to emerge in a long time."

FIG. 1

ENGINEERING/TECHNICAL WORKSTATION MARKET 1985 MARKET SHARE

COMPANY	REVENUES ($ MILLIONS)	MARKET SHARE (%)
Apollo Computer Inc.	290	31
Hewlett-Packard Co.	186	20
Sun Microsystems Inc.	149	16
Digital Equipment Corp.	92	10
Symbolics Inc.	69	7
Data General Corp.	29	3
Silicon Graphics Inc.	27	3
Other	87	9

SOURCE: DATAQUEST INC., SAN JOSE

Sun has two main oem programs, according to Cuhling. There's the Marketing Assistance Program, in which salesmen get commissions for helping oems make sales. And there's the Catalyst program, involving joint marketing with an oem willing to sell its software unbundled. Sun sells the hardware, and the oem sells the software. Sun gives a 40% discount for development systems under the Catalyst program, Cuhling adds.

Digital Equipment Corp. Richard Lewan, workstation marketing manager at the minicomputer giant, says DEC has four products for the workstation market—the VAXstation II/RC, a monochrome system for about $15,000; the VAXstation II, a monochrome system for $20,000 to $25,000; the VAXstation II/GPX, a color system in the high $20,000s to low $50,000s range; and the VAXstation 500 series, with color and 3-D graphics in the $40,000 to $50,000 range.

"We offer much the same for our workstation oems as for the oems of our other products," Lewan says, declining to get into actual discount numbers. "We provide the hardware platform and base-level software, technical support, and software consulting. We have a systems co-op marketing program for oems in markets that we want to jointly address. We make joint sales calls and do it so that there's no question who gets the credit.

"We've been in the oem business for 27 years and we think we understand what it takes to make oems successful," he concludes.

Hewlett-Packard. Peter Hamilton at Hewlett-Packard's Fort Collins Systems Division, where HP makes its workstations, says his company serves the market with its Integrated Computer and its HP 9000 series.

The Integrated Computer is a 68888-based Unix machine starting at $5,000. The HP 9000/300, described by Hamilton as "the heart of our development environment and a delivery vehicle for engineering workstations," runs Unix. It is based on the 68010, communicates under SNA, has an entry price of $15,000, and a typical configuration price of $30,000. Then there's the HP 9000/500, intended as a file server, with a typical price of $50,000, and the HP 9000/800, which came out in June and which Hamilton compares to the VAX 8600 in performance, with an entry price of $115,000 and a typical price of $200,000.

Hamilton says oems receive a 40% discount for the development system, a dedicated support organization, and a Software Evaluation and Migration Center.

AT&T UP TO SOMETHING

AT&T. The best that can be said for AT&T at the moment is that the company is up to something. "We're attacking the market on two fronts," says Mark Segal, an AT&T spokesman. "We have a minority interest in Counterpoint Computers in San Jose. What they will make has not yet been determined. Also, there's Omni CAD Corp. in Pittsford, N.Y., a niche vendor in the CAD market, selling AT&T Omni Draft for the AT&T 6300," an IBM PC clone.

A Counterpoint spokesman adds that his firm makes a 68000-based, multiple-cpu multi-user machine called the System 19. Several systems have been shipped to AT&T, which has talked about announcing a Counterpoint-based workstation,

"New power is being installed in the form of distributed logic workstations."

though nothing has come of it yet.

Meanwhile, Herb Weiner, president of Omni CAD, says his firm recently did some beta tests on a high-performance 68020-based workstation for AT&T and supplied some to Omni CAD customers for beta testing. "The workstation has passed the tests, but [AT&T's] plans for selling the hardware are not clear to me," he says. Weiner won't describe the system further.

The main thing all these vendors have in common is that their hardware is getting cheaper. While undoubtedly welcome news to users, sales strategies for big-ticket items no longer work when the ticket becomes small. The manufacturers may be counting on their oems to reduce the cost of selling, but that simply shifts the problem onto the oems' lap.

"Oems or vars maintain their own direct sales forces to go after Fortune 1000 accounts, and some slowdown in the market could be attributed to crowding in those accounts," says Apollo's Green. "They must sell to other, smaller accounts, but they can't afford to with the present business model. So we are looking at microcomputer dealers.

"AutoCAD [software from Autodesk Inc., Sausalito, Calif.], for instance, has dealers doing business with tiny architectural firms and small businesses. Can they sell our hardware as well? And will they do it, and will the oems follow suit?"

Sun's Cuhling agrees. "As the hardware gets cheaper, the big customers will buy more," he predicts. "But we will need another channel to reach the smaller customers. The trend is definitely toward dealer or var channels, and we are looking very hard at those channels. At the low end, complementary channels become inevitable."

Hewlett-Packard is addressing alternate channels through its Advanced Dealer Program—generally involving vars who have their own computer centers.

In the meantime, the oems are changing, as are the marketing channels. "We are seeing more people who used to be oems, or who started out intending to be oems, realizing that they don't add that much hardware value for their customers," says Cuhling. "They are moving to become software vendors. In the old days, they had to modify the hardware to get what they wanted, but this is no longer necessary.

"We are not trying to push the oems into being software vendors," he adds, "although software sales is a better business model for most of them. Of course, we have higher margins on the hardware we sell directly, but we also have higher selling costs."

"You still see classical oems, doing lower-level programming or special interfaces, but the trend is toward higher-level programming and the value added in software," concurs HP's Hamilton.

MONEY ON THE TABLE

Still, many oems would agree with Fred Egan, vice president of third-party marketing at Interleaf Inc. in Cambridge, Mass., which resells Apollo, Sun, and DEC hardware. He says, "Hardware sales represent money on the table that we feel we should participate in."

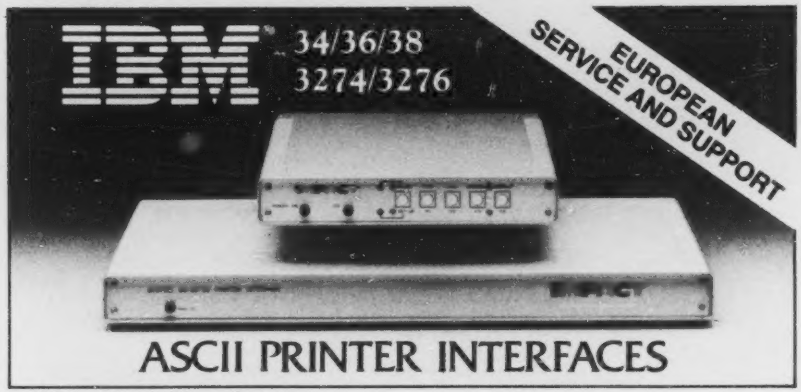
And several sources describe a problem best summed up by Massood Zarrabian, divisional vice president for mechanical design and CAM software at Sun oem Computervision Corp. in Bedford, Mass. "It's not enough to make one engineer productive if you can't do anything with his output. It's like the PC or database markets earlier—you solve a local productivity problem, but create a major process problem. So the market expands as problems are solved, and then contracts as users find new problems."

The vendors address Zarrabian's concern by emphasizing connectivity, modestly adding that they offer whatever's required. But one wonders if what's needed isn't some higher level of organizational integration, something that may not be embodied in any particular product.

The engineering/technical workstation market is far from being all gloom and doom, however. Sources agree that there are still niches opening up for oems to exploit: desktop publishing, computer aided testing of circuit designs, silicon compilation (the automatic design of IC circuits from a high-level description), solids modeling, and shop floor control are among those frequently mentioned.

And doubtless there will be other niches to explore. But if trends continue, they'll involve independent software vendors and vars, rather than oems, using a hardware platform with exciting power so cheap that it's increasingly sold through microcomputer distributor channels. ◉

Lamont Wood is a free-lance writer based in San Antonio.



IBM 34/36/38 Interface
Impact provides emulations for IBM 5219, 5224, 5225 and 5256 printers.
Device addresses can be set on the interface and the interface supports cable through or terminate designations.
IBM 3274/3276 Interface
Impact's 3274/3276 interfaces provide complete IBM 3287 printer emulations.
Interface Design
Impact's interfaces are available in small robust external interface boxes or alternatively very practical slim line interfaces that have a large base plate that supports the footprint of most printers minimising the amount of desk space required.
Impact
Impact is an Australian company whose R&D activities commenced in 1977. The Company has powerful shareholders like Citicorp, Westpac, Aetna Life Insurance, Security Pacific Bank, BT, Pratt, CDFC, Koitaki and Macquarie Bank.
Distributor enquiries: 61-2-406 6611
Telex AA 176123 Fax 61-2-406 6218
® IBM is a registered trademark of IBM Corporation, Inc.
IMPACT SYSTEMS LIMITED, 7 GIBBES STREET, CHATSWOOD, SYDNEY 2067, AUSTRALIA.
IMPACT
TECHNICAL EXCELLENCE FROM DOWNUNDER
CIRCLE 89 ON READER CARD